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MAGAZINE OF NATURAL HISTORY,

INCLUDING

ZOOLOGY, BOTANY, AND GEOLOGY.

(BEING A CONTINUATION OF THE 'ANNALS' COMBINED WITH LOUDON AND
CHARLESWORTH'S 'MAGAZINE OF NATURAL HISTORY.')

CONDUCTED BY

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"Omnes res creatæ sunt divinæ sapientiæ et potentiæ testes, divitiæ felicitatis humanæ:—ex harum usu *bonitas* Creatoris; ex pulchritudine *sapientia* Domini; ex œconomiâ in conservatione, proportione, renovatione, *potentia* majestatis elucet. Earum itaque indagatio ab hominibus sibi relictis semper æstimata; à verè eruditis et sapientibus semper exulta; malè doctis et barbaris semper inimica fuit."—LINNÆUS.

"Quel que soit le principe de la vie animale, il ne faut qu'ouvrir les yeux pour voir qu'elle est le chef-d'œuvre de la Toute-puissance, et le but auquel se rapportent toutes ses opérations."—BRUCKNER, *Théorie du Système Animal*, Leyden, 1767.

. The sylvan powers
Obey our summons; from their deepest dells
The Dryads come, and throw their garlands wild
And odorous branches at our feet; the Nymphs
That press with nimble step the mountain-thyme
And purple heath-flower come not empty-handed,
But scatter round ten thousand forms minute
Of velvet moss or lichen, torn from rock
Or rifted oak or cavern deep: the Naiads too
Quit their loved native stream, from whose smooth face
They crop the lily, and each sedge and rush
That drinks the rippling tide: the frozen poles,
Where peril waits the bold adventurer's tread,
The burning sands of Borneo and Cayenne,
All, all to us unlock their secret stores
And pay their cheerful tribute.

J. TAYLOR, *Norwich*, 1818.



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THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[SEVENTH SERIES.]

"..... per litora spargite muscum,
Naiades, et circum vitreos considite fontes :
Pollice virgineo teneros hic carpite flores :
Floribus et pictum, divæ, replete canistrum.
At vos, o Nymphæ Craterides, ite sub undas ;
Ite, recurvato variata corallia trunco
Vellite muscosis e rupibus, et mihi conchas
Ferte, Deæ pelagi, et pingui conchylia succo."

N. Partheni Giannettasi, Ecl. 1.

No. 1. JANUARY 1898.

I.—*Some new Parasitic Copepods found on Fish at Bombay.*
By P. W. BASSETT-SMITH, Staff-Surgeon R.N., F.R.M.S.,
F.Z.S.

[Plates I.—VII.]

THE continuation of the investigation of the parasitic Copepoda of fish which I commenced at Plymouth (see *Ann. & Mag. Nat. Hist.*, July 1896, and 'Journal of the Marine Biological Society,' February 1896) was much favoured by my being stationed for a lengthy period at Bombay : this was all the more interesting as it practically opened up an almost unknown field, for, beyond the valuable works of Dr. Heller and Kröyer and some stray notes, there has hardly been anything written about these minute animals living on fish found in Eastern waters ; and as apparently many individual fish, or, at least, genera of them, have organisms peculiar to themselves preying on them, it is not surprising that a comparatively large number of new species should have been obtained.

As in England, it was noticed that those specimens which most frequently provided parasites were not in any way in bad condition, or showed only in exceptional cases evidence of their presence being harmful to the host. These parasites

may be roughly divided into two classes—the blood-suckers and the mucus-eaters. Of the former are here described species of *Lernanthropus*, *Peroderma*, and *Lernæonema*; the last, as exemplified by *L. polynemi*, must indeed cause a great amount of irritation and trouble to its host, being found in such numbers on a single fish and burrowing so deeply into the flesh: the second group includes the “Caligidæ,” with *Bomolochus*, *Brachiella*, *Chondracanthus*, &c. The species of *Caligus* were seen very actively moving about in the gill-cavity or on the surface of the fish, rarely causing any trouble; the latter two fixed, but not deeply, the long neck of *Brachiella* and *Anchorella* being seen twisting about so as to apply the head to different spots as wanted. The manner in which the free-swimming embryos find their respective hosts is not known and is curious to think of. On the tail of one *Caranx Rottleri* I found some half-dozen specimens of an immature *Caligus* attached by the frontal filament.

I have as far as possible followed Gerstaecker's system; but there is a great deal of discrepancy between the various authors, and in some the plates and descriptions are very meagre. The character of the antennæ, which would seem to be a feature on which “generic” classification might be based or assisted, is in *Lernanthropus* quite lost, for Heller represents all his specimens with two-jointed anterior antennæ (if correctly figured and described), whereas Krøyer's and my specimens invariably have six- or seven-jointed antennæ, which is, I believe, the normal form. The genus *Bomolochus* might well be divided into two subgenera—first, those with elongated rostrum and anterior antennæ provided with long bristles, as *B. megaceros*, Heller, and *B. tricerus*, sp. n.; and second, those with short rostrum and anterior antennæ unprovided with bristles, as in *B. gracilis*, Heller, *B. tetradonis*, &c.

I have been forced to create a new genus—*Helleria*—for a species of the family Dichelesthina taken from the gills of *Cybbium guttatum*, which, though closely connected with Heller's *Pseudocycnus*, yet is, I think, distinct.

Finally, I may say that for preservative purposes, though a solution of formol keeps the soft-bodied specimens well, yet it has a tendency to blacken the chitinous-coated ones, as *Caligus* &c.

Ergasilidæ.

Bomolochus tricerus, sp. n. (Pl. I. fig. 1.)

Many specimens of this species were taken at Bombay from

the gill-cavities of *Stromateus cinereus* (white pomfret), both male and female: it differs essentially from *B. megaceros* of Heller, which he found on *Stromateus niger*, on which fish I frequently also found that species; it, however, bears outwardly a nearer resemblance to *B. scomberesoces* of Kröyer, but differs from the latter in detail, the three setaceous horns being much more pronounced, the last joint of the fifth peræopoda having four instead of three short setæ, &c. (see Pl. I. fig. 1).

Female.—Body elongate; cephalothorax 5-partite, first segment much broader than long. Frontal border deeply concave in the middle line. *Anterior antennæ* elongate, basal joint arcuate; at the inner end there is placed a trilobate process, the root of which connects with a curious circular disk, the anterior margin of which is fringed with fine hairs; from each lobe of this frontal appendage springs a strong simple sharp bristle, the inner being slightly the longest; there are also three more simple bristles from the anterior frontal border, the one immediately outside the frontal process being long and very slender, the other two much shorter. The whole anterior border is fringed with about twelve finely plumose setæ, two being inside the frontal process, three between first and second bristles, and two between second and third; there are four elongated free joints provided with fine hairs at the angles, the last with seven at the extremity. *Posterior antennæ* biarticulate, second joints minutely granular, terminating in a thickened crenulate pointed process, and four fine simple setæ, the inner border finely dentate, the teeth becoming much coarser near the end and elevated. *Hamulus* placed laterally; it is large and two-jointed, the second joint made up of an elongated hook with a ciliated appendage of equal length. *Rostrum* very long and pointed. *First peræopods* two-branched, outer with one joint, the inner with two, all provided with plumose hairs; second, third, and fourth two-branched, each with three joints, the outer branches carrying on the outer side short spur-like bristles, the others plumose; fifth single-branched, the last joint being provided with three short bristles terminally and one on the outer border. *Genital segment* square. *Abdomen* of four joints, decreasing in size downwards, the last bearing the *caudal plates*, which are longer than broad, giving off one very strong central bristle and two short fine lateral ones; also a minute hair is seen on the outer border.

Egg-sacs large, dilated.

Male smaller, but differing slightly from the female.

Bomolochus tetradonis, sp. n. (Pl. I. fig. 2.)

These specimens were found abundantly in the gill-cavities of *Tetrodon oblongus* at Bombay; both sexes were generally present together in the same fish. They resemble somewhat *B. gracilis* of Heller, which he found on the hammer-headed shark at Java, but differ in detail. By obtaining a large number of specimens it was found to vary very much in form, proportionally of length to breadth, even in mature females, as shown in Pl. I. fig. 2; so that the mere external conformation is of comparatively little assistance in differentiation of the species (in mounted specimens the frontal border always folds backwards and renders examination difficult).

Female.—Cephalothorax pyriform or elongated, divided into five distinct segments, arched dorsally. First segment shorter than long, second to fifth becoming progressively more so. *Anterior antennæ* arcuate, elongate, bearing on the front edge about sixteen short setæ with rounded bases; three free club-shaped joints, the last being provided with many short bristles. *Posterior antennæ* two-jointed, terminating in five (?) short setæ. *Hamulus* placed far forwards and to the side, in the shape of a very strong, short, thick, slightly curved spur.

Mouth-organs are placed between a well-marked upper and lower lip, there being no sharp-pointed rostrum as in the last species; into this space project three pair of appendages, the most anterior, the *mandible*, having three joints, the last consisting of a long curved pointed joint, with its convex border finely crenulate and an accessory palp; the second being the *first maxilliped*, also three-jointed, the first joint being long and cylindrical, the second short, and the third in the form of a strong slightly curved claw; the third being the *second maxilliped*, larger, with a thicker basal joint, terminal joints simple, with finely dentate concave margin.

First four *peræopods* two-branched, second to fourth each with three joints, provided with plumose hairs on the inner border and with more or less elongated simple bristles on the outer, that of the second joint of the inner branch of the second pair being very long and strong.

Fifth *peræopod* three-jointed, the last joint being provided with three short bristles only.

Genital segment short and broad. *Abdomen* consisting of four joints progressively decreasing in size, the last terminating in two caudal plates nearly three times as long as broad, carrying two long terminal bristles and two short lateral ones.

Family Caligidæ.

Genus CALIGUS, Müll.

Caligus parvus, sp. n. (Pl. II. figs. 1, 2.)

This species was found very frequently on the inner surface of the operculum and also free on the surface of *Tetrodon oblongus* from Bombay Harbour; they were often seen actively moving about, and were of a pinkish colour, both sexes being equally common. I have been unable to place this species with any known ones, though it bears a resemblance to *C. abbreviatus*, Kr., in form, but differs in detail (Pl. II. fig. 1).

In the female the cephalothorax is almost circular, slightly broader than long, equalling in length the remainder of the whole; it narrows anteriorly, where it unites with the frontal plate, being evenly rounded at the posterior angles. The frontal border is narrow, concave in the centre, and bears small lunulæ in the outer third. The first joint of the *anterior antennæ* is short and thick, with about twenty short plumose setæ on the front border; the second joint is shorter and carries fine hairs at the end. *Posterior antennæ* are placed a short distance behind the frontal plate, are three-jointed and of moderate size. *Hamulus subsidiarius anterior* is in the shape of a short hook with a dilated base. *First maxilliped* is very slender, ending in two small claws, the outer being the longer. *Second maxilliped* very large and characteristic, the end claw being extremely strong and thick, the basal joint having a large process to which the other is opposable. *Furcula* is small, with very short blunt branches, spreading but slightly.

The first of the swimming-feet (peræopoda) has a short basal joint, elongated second, and the third terminating in three short bristles, with four elongate plumose setæ on the posterior border, the one at the angle being the longest.

Genital segment is square, with rounded angles. The abdomen is very short, carrying extremely short caudal plates; these are as broad as long, and are provided with three long plumose setæ terminally and two minute short hairs on the outer border.

Length 3·4 millim.

Male.—This has the after portion of the body more elongated, the posterior angles of the genital segment produced, carrying two fine hairs, the caudal plates are longer; but the most characteristic change is in the great development of the accessory hook, probably for better holding the female.

Length 2·3 millim.

Caligus cybii, sp. n. (Pl. II. fig. 3.)

This species was found in the gill-cavity of *Cybium lineolatum* at Bombay. Only one specimen, a female.

Cephalothorax longer than broad, contracted in front. Frontal plates bearing small lunulæ. *Anterior antennæ* with basal joint short and stout, terminal club-shape. *Posterior antennæ* with strong recurved hook. *Hamulus* short, with broad base. Palp at the base of first maxilliped long and thin. Second maxilliped provided with a narrow, slightly curved claw, nearly as long as basal joint. *Furcula* rather large, with slightly curved, simple, divergent branches. *First peræopod* having the extremity of the terminal joint provided with three rather strong short bristles, the anterior being the shortest; at the angle a fine plumose hair, with three rather long plumose ones on posterior border. Second peræopods carry on the outer border of the joint's outer branch two slightly curved chitinous hooks; the hamulus posterior on the third peræopod being shorter and thicker. Fourth peræopod has the terminal joint provided with three long, fine, curved, simple setæ, with a minute spur at the angle, the penultimate and postpenultimate portions also bearing simple curved setæ; the last four are in close proximity. *Genital segment* almost oblong, with slightly lobed and rounded posterior angles. Abdomen half length of cephalothorax, nearly four times as long as broad, indistinctly two-jointed, the last joint being as long as broad. Caudal plates equalling in length last joint of abdomen; they carry three short plumose bristles at the extremity and a shorter one on the outer border.

Total length 5 millim.

This species differs from *C. pelamydis*, Kr., in its longer cephalothorax, shorter abdomen, and structure of the furcula and fourth peræopods.

Caligus hirsutus, sp. n. (Pl. III. figs. 1, 2.)

This species was very commonly found in the gill-cavity of *Polynemus tetradactylus* at Bombay. It was extraordinary on account of the peculiar dilated condition of the abdominal segment, which I at first took to be an abnormality; but as it was apparently universally present in the females, it must be taken as the normal condition. Also the rosette-like bunches of hairs at the base of each of the thickened setæ of the fourth peræopods were quite unique; though very distinct in the fresh specimens, these hairs were exceedingly difficult to detect in mounted ones, except when in glycerine (Pl. III. fig. 1).

Female.—Cephalothorax oval, nearly twice as long as broad, about one third of the total length. Frontal plate slightly concave in front; lunulæ shallow, but of considerable diameter. *Anterior antennæ* having the basal joint slightly longer than the width of the lunula; setæ markedly plumose, the outer being strongest; second joint club-shape, about seven short bristles at the end. *Posterior antennæ* in the form of a long, much curved hook; spur at the base sharp. *Hamulus* very small and short. Palp at the base of first maxilliped long and sharp. *Second maxilliped* with the terminal joint in the shape of a long recurved simple claw. *Furcula* small, with straight-edged but slightly spreading branches. There are three very short simple setæ on the last joint of first peræopod, with only three longer plumose ones on posterior border; the second joint has the edge fringed with fine hairs. *Hamulus* posterior on third peræopod small and curved. Fourth peræopod: first joint strong, the terminal joint consists of three parts welded together, forming a blunted extremity, the last having on its inner border three short, thickened, slightly curved simple setæ, the first with its inner border crenate, the next joint bears a fourth close to these, and at the base of each is a rosette-like bunch of fine hairs of a dark colour.

Genital segment is much wider posteriorly and is deeply lobed. The abdomen is as long as the cephalothorax, having this dilated to an equal width with the last joint, being of a dull semitransparent appearance. Caudal plates longer than broad, bearing three terminal plumose bristles, the centre one being much the longest; there is also a shorter one on the outer border.

Length 7 millim.

Male has an oval genital segment, the abdomen divided into a short and following elongated portion, with caudal plates much longer than in female (Pl. III. fig. 2).

Caligus Phipsoni, sp. n. (Pl. III. figs. 3, 4.)

This species was found free on the inner surface of the gills of *Cybbium guttatum* at Bombay; only a few specimens of both male and female were taken. In general form it resembles *C. irritans*, Heller, but differs in having the cephalothorax rather broader, the furcula larger, the abdomen single-jointed, and in the arrangement of the bristles on the caudal plates (Pl. III. fig. 3).

Female.—Cephalothorax longer than broad, slightly narrowed anteriorly, rounded at the angles posteriorly, slightly

lobed. Frontal border slightly concave. Lunulæ very large, the whole thickness of the plate. *Anterior antennæ* having the basal joints short and thick, with about fifteen plumose setæ on front border, with simple bristles near outer end; second joint dilated at end, with seven fine bristles. *First maxilliped* very slender; no setæ seen on second joint, as in *C. irritans*. *Second maxilliped* having the end claw strong but short, provided with a short bristle on concave border one third from point. *Furcula* with narrow, pointed, slightly spreading branches, from a wide base. The terminal joint of the first peræopod has three short bristles at the end, decreasing in length from first to third; at the angle there is a fine plumose hair and on under border three longer similar ones with thickened bases. Fourth peræopods are long, the terminal joint provided with five moderately long, curved, simple claws, the last three being close together. *Genital segment* oblong, with the posterior angles slightly produced, three fourths as long as the cephalothorax. Abdomen short, half as long as the last segment, single-jointed, slightly constricted anteriorly. Caudal plates rather longer than broad, terminating in three moderately long plumose setæ, and having a shorter one on the outer border.

Length 5 millim.

The *male* has the cephalothorax much more elongated, the genital segment is more pyriform, and the abdomen longer; the hamulus anterior is also very long and sickle-shaped (Pl. III. fig. 4).

Length 3 millim.

Caligus longicaudus, sp. n. (Pl. IV. figs. 1, 2.)

This species was found in small numbers of either sex in the gill-cavities of two fish in Bombay Harbour—*Trichiurus haumela* and *Chirocentrus dorab*. It differs from *C. productus*, Dana, by the short genital segment, the absence of the deep notch on the frontal plate, by its less sharply pointed furcula, and in the detail of the first peræopods &c.; from *C. trichiura*, Kr., by the longer cephalothorax, larger and deeper lunulæ, and different shape of the furcula.

Female (Pl. IV. fig. 1).—Cephalothorax almost a perfect oval, with the posterior angles rounded, less than half the total length. Frontal plate with slightly convex anterior border; lunules large, extending the whole depth of the plate. *Anterior antennæ* having the basal joint short, not quite so long as the diameter of the lunula; it is provided on its anterior border with eight rather stout, short, plumose

setæ, the ones nearest the lunulæ being the largest; at the end are three strong bristles, equalling in length the second joint, which terminates in three or four long bristles and several short ones. *Posterior antennæ* three-jointed, the last in the form of a strong hook, the basal joint carrying a sharp pointed process. *Hamulus* very small and blunt. *First maxilliped* having a long pointed palp at the base; terminating in a bifid claw at the end, not very long. *Second maxilliped* with a stout basal joint, having a small spur at the base; terminal hook shorter than the basal joint. *Furcula* with a wide elongated base, giving off from a narrow neck two flattened, blunt, almost straight, simple branches. First peræopods three-jointed; there is a small short spur at the outer end of the anterior border of the second joint; the third is short and carries three short terminal bristles, the posterior border being provided with three long finely plumose setæ. The second peræopod has the terminal joint of the outer branch furnished with eight long plumose setæ, the anterior border with three short simple bristles, the first joint bearing two long chitinous spines. Third peræopod shows a very small straight hamulus posterior. Fourth peræopod is strong, terminating with four long, slightly curved claws placed close together, and a fifth about halfway up the inner border. *Genital segment* broader than long, posterior angle lobed, bearing a rudimentary fifth limb, furnished with three plumose hairs. Abdomen indistinctly two-jointed, almost as long as the cephalothorax. Caudal plate longer than broad, with three long terminal plumose setæ and two shorter ones on the outer side, also one on the inner border.

The male (Pl. IV. fig. 2) has a more elongated genital segment, a more distinctly two-jointed abdomen, the second maxilliped is very strong, the claw being provided with a small bristle near its lower third; and on its basal joint, front border, are one single and three bifid tubercles.

Caligus (Sciænophilus, Van Ben.) Benedeni, sp. n.
(Pl. IV. fig. 3.)

This species I have only taken once—a female, from *Sciænia diacanthus*, at Bombay.

Cephalothorax one fifth of the whole length and much less broad than the genital segment; it is almost circular in shape, bearing fairly strong frontal lobes with a straight border; the lunulæ are very small. Basal joints of *anterior antennæ* provided along the anterior border with about twelve very fine plumose setæ, the second having at its thickened end two

long and several short hairs, also one or two on the posterior border.

Posterior antennæ small, acutely bent. First maxilliped very slender, second with very strong simple end-claw, which is slightly granular on high magnification.

First peræopod with three long end-bristles and three moderately long plumose setæ on the posterior border.

Fourth peræopod having four long, slightly curved, terminal claws close together and a fifth halfway down the inferior border.

Genital segment rather longer than broad, much larger than cephalothorax. Abdomen long, thick, single-jointed, constricted at the anterior end. Caudal plates longer than broad, curved inwards, with three long terminal setæ and a shorter one on the outer side (Pl. IV. fig. 3).

Length 6 millim.

This subgenus seems to be found most regularly on the "Sciænidæ," the comparative small size of the cephalothorax, small lunulæ, and extremely large maxillipeds being very distinctive.

Family Dichelesthina.

Genus HELLERIA, nov.

Body elongate, without dorsal plates; head rounded. Anterior antennæ setaceous, six- or seven-jointed. Posterior antennæ in shape of strong hooks. First maxillipeds small, second in form of large claws. Thorax three-jointed, each provided with a soft lateral process. Three pair of rudimentary limbs only present—first biramose, second uniramose, third stump-like.

Genital segment about three times the length of head and thorax. Caudal plates of moderate size, lancinate.

Male.—Smaller, but differing slightly from female.

This genus should be placed between *Clavella* of Oken and *Pseudocyrenus* of Heller, being most nearly related to the latter, but having these generic differences:—(1) many-jointed anterior antennæ; (2) three-jointed thorax, bearing only three pair of limbs; and (3) enormously enlarged second maxillipeds.

Helleria armata, sp. n. (Pl. V. figs. 1, 2.)

A number of specimens of this species were found in the gills of a *Cybbium guttatum* at Bombay, both sexes, colour dull opaque white.

Length about 8 millim.

Female (Pl. V. fig. 1).—Head almost round. *Anterior*

antennæ six- or seven-jointed, first joint broad, second elongate, with fine hairs at the base and a lobe-like process from the front border equalling in length the segment, third joint with three fine hairs, fourth with two, fifth and sixth with two, and terminal joint with seven bristles. *Posterior antennæ* three-jointed, last in the form of a strong hook, with a well-marked tooth on the concave border near the centre. *Rostrum* in the form of a short strong chitinous tube. *Maxillary palp* three-jointed, the last joint being sharp and curved. *First maxilliped* three-jointed, the basal joint being thick and muscular, the second cylindrical, the furthest end of the inner border being finely dentate; last joint short, sharp, curved, and dentate on concave border. *Second maxilliped* two-jointed, the basal joint being of very great size and muscular, its lower margin undulate and fringed with bunches of fine hairs; second joint in form of a strong curved claw, the internal border being armed with a strong tooth. *Thorax* three-partite, the first segment having a soft lateral rounded appendage on either side, those of the next two segments being longer; under the first is seen a small plate with edge finely ciliated, giving off the rudimentary first two-branched peræopod, the outer an oval single-jointed limb terminating in one minute hook and two short hairs; the inner branch is shorter and carries three minute hairs. Under the second appendage is another plate carrying a single-jointed limb, terminating in a small hook, and the inner edge being provided with many fine hairs. Behind the third appendage, springing from the anterior portion of the genital segment, is a minute stump, from the apex of which is a single bristle.

Genital segment constricted in front, twice as long as head and thorax, indistinctly lobed at the posterior extremity. Two elongate foliaceous caudal plates. Egg-sacs long, thin.

Male (Pl. V. fig. 2).—Body shorter, head more oval. *Posterior antennæ* longer than in the female; no thoracic appendages. Maxillipeds are also less robust, but very long and powerful. The rostrum is longer, and on either side of the lower lip is a sharp, slightly curved, very long, articulate movable process directed directly backwards, equalling about half the length of the head.

Both terminal joints of first peræopods have comparatively strong claws—in fact, these paired limbs are more developed in the male. Genital segment elongate, tapering posteriorly, where a rounded abdominal portion is distinctly marked off, carrying two caudal foliate appendages, the extremity being fringed with fine hairs.

Genus LERNANTHROPUS, Nordm.

Lernanthropus trifoliatus, sp. n. (Pl. VII. fig. 3.)

This species was taken from the gills of *Polynemus tetradactylus* in Bombay, but was rare; four were taken from one fish, two on either side, all being mature females. When taken from the body they were distended with sanguineous fluid (Pl. VII. fig. 3).

Female.—Head oblong, with rounded angles, strongly notched in front, folding inwards on under surface. Dorsal scutes bipartite, anterior segment pyriform, constricted at the neck. Posterior scute much dilated and rounded, from under which project the fourth pair of foliaceous peræopods. *Anterior antennæ* six-jointed, setiferous; posterior two-jointed, terminating in a strong simple claw. Feet of third pair in the form of strong lamellar plates directed outwards, curved, folding on themselves like a leaf, projecting slightly beyond first dorsal scute. Fourth pair in the form of elongate lamellar processes, two of which project considerably beyond the posterior margin of the second scute; the third is more acuminate, shorter, and placed beneath the other two. Abdominal segment longer than broad. Caudal plates of moderate size, simple, lancinate.

Length 8 millim.

The six-jointed anterior antennæ, elongated plates of fourth peræopods, which consist of three processes, and short genital segment differentiate this species.

Family Lernæoidea.

Genus LERNÆONEMA, M.-Edw.

Lernæonema polynemi, sp. n. (Pl. VII. fig. 1.)

This species was found very frequently, of all sizes, one or more being almost always present on well-grown specimens of *Polynemus tetradactylus* taken in Bombay; and they must be a great pest to this fish. Often as many as a dozen were found on one, the head and neck deeply buried into the flesh; the body was full of blood, and yet the host appeared always well nourished. The favourite sites were:—(1) at the base of the caudal (I have traced the neck in on one side, and passing between the vertebræ found the head near the surface on the other); (2) behind the dorsal fin; (3) just behind and

above the pectoral. Near the point of insertion there was often an area of extravasated blood from irritation.

This species resembles most *L. encrassicola* of Baird, but the sharp cephalic processes are less spreading and the neck is much longer. Male not found.

Female (Plate VII. fig. 1).—Length of head 2 millim., of neck 4 centim.; body 15 millim., abdomen 13 millim.

Head triangular, with blunted end, terminating posteriorly on the under surface in three short horns, the lateral being slightly divergent, all sharply pointed. At the blunted extremity in young specimens two pair of antennæ are visible, the anterior indistinctly three-jointed, provided with fine hairs at the extremity. *Posterior antennæ* with two short thick joints, the second bearing a strong thick recurved hook, which opposes a tubercle of the outer side of the same. Mouth-opening circular, near extremity on the underside, border ciliated. There are four pair of limbs placed a short distance posterior to the mouth; they are very small: the first and second limbs are two-branched, each having two joints, the last fringed with plumose hairs; the third and fourth limbs single-branched, three-jointed, the last carrying four plumose hairs. *Genital segment* elongated, flask-shape. Abdomen simple, straight, tapering slightly from the base, extremity blunt. Egg-sacs very long and fine, bright green when alive.

Genus PERODERMA, Heller.

Peroderma branchiata, sp. n. (Pl. VII. fig. 2.)

A single example of this species was found on a small fish at Bombay—*Coilia Dussumieri*—the front two thirds being buried into the flesh above the pectoral fin, the posterior portion and egg-sacs only being visible; the bulbous anterior extremity was directed upwards, inwards, and forwards, the head at right angles above the ribs. This genus is described by Heller with a single species; it seems to be sufficiently distinct to be retained. (Pl. VII. fig. 2.)

Female.—9.5 millim. long without the egg-sacs. Body cylindrical, with a slight curve backwards at the posterior extremity. Anterior portion in front of neck rounded, one fourth of total length; neck narrow, cylindrical, longer than broad, placed at right angles to the body, bearing a thickened lobed head, furnished with a great number of fringed processes; these on higher magnification show the terminal branches to have a very regular manner of division, a bifid

end with a third longer side branch. Egg-sacs three or more times as long as the body. The arrangement of mouth-organs &c. was not made out, as I did not wish to sacrifice the specimen.

Length 9 millim.

Family Chondracanthina.

Genus CHONDRACANTHUS, La Roche.

Chondracanthus elongatus, sp. n. (Pl. VI. figs. 4-6.)

Several specimens of this species were obtained from the gills of a sole (sp. ?) at Bombay. Most were mature females, and on some of these pigmy males were found attached singly near the genital pore (Pl. VI. fig. 4).

Female.—Length 6 millim. Head oblong, with greatly indented sides; median groove dorsally well marked; it equals one seventh total length. From the front border arise two long, simple, soft antennæ, as long as the head. *Posterior antennæ* placed immediately behind them in the form of two long slender hooks. Mouth-organs, as in others of this genus, placed near the neck. Thorax giving rise to two pair of slender processes, bifurcating at the ends. *Genital segment* elongated, cylindrical, with posteriorly two simple elongate processes, rather more than one third length of that segment. Abdomen short, rounded. Caudal plates simple, one third length of posterior appendages.

This species resembles somewhat *C. alatus*, Heller, found by him on a "*Gadus*," which species I have also taken here from gills of *Psettodes Erupei*.

Male (Pl. VI. fig. 6).—Very small, pyriform. *Posterior antennæ* placed at the anterior extremity in the form of short recurved hooks. *First maxilliped* with thick basal joint and well-marked prehensile simple claws. *Second maxilliped* more attenuated, with a simple straight spine. Body indistinctly segmented; two narrow, terminal, lanceolate caudal processes.

Family Lernæopodidæ.

Genus BRACHIELLA, Cuv.

Brachiella appendiculosa, sp. n. (Pl. VI. figs. 1-3.)

Several specimens of this species were taken from the gills of fish in Bombay Harbour, viz. *Stromateus niger* and *Poly-nemus tetradactylus*. Its characters were well-marked and

both sexes were found, the pigmy male being single, attached usually to the genital segment under the arms of attachment (Pl. VI. fig. 1).

Female.—Cephalothorax in the same straight line as the body, rounded anteriorly, somewhat dilated. *Second maxillipeds* equalling in length the cephalothorax, directed downwards and forwards, widely separated from base to extremity, where they unite and give rise to a well-marked stalked disk of attachment; on the under surface of each arm is a process giving off four elegant elongated filaments. Body (genital segment) oval, constricted in front; from the posterior extremity on either side is a prolonged bifid appendage; centrally two small caudal lanceolate plates are present.

Length 6 millim.

Male (Pl. VI. fig. 3).—About 1 millim. long. *Cephalothorax* distinct from the body, which is long and indistinctly segmented, terminating in two short caudal processes. Anterior portion of the cephalothorax carrying the mouth-organs and antennæ. *Anterior antennæ* three-jointed, with three fine bristles at the end of the last joint. *Posterior antennæ* terminating in a thickened joint with a short tubercle on outer side, and the inner with a small recurved hook. *Mandible* long, with bifid end; extremity of mouth finely ciliated. Both pair of maxillipeds large; the first provided with a very strong hook, the second with a much smaller one.

I have not either the plate or description of "Steenstrup and Lütken" to refer to with regard to their *B. appendiculata*, and have therefore provisionally called this species as above.

EXPLANATION OF THE PLATES.

PLATE I.

Fig. 1. Bomolochus tricerus, ♀, sp. n., from back, magnified.

1 a. From underside, more enlarged. 1 b. Hamulus. 1 c. Posterior antennæ. 1 d. First peræopod. 1 e, f, g. Third, fourth, and fifth peræopods.

Fig. 2. Bomolochus tetradonis, sp. n., ♀, from back, enlarged.

2 a. Antennæ with mouth-organs, seen from beneath, much enlarged. 2 b. Terminal joint of posterior antennæ. 2 c. Extremity of second maxilliped. 2 d, e, f, g. Second, third, fourth, and fifth peræopods. 2 h. Caudal plate.

PLATE II.

Fig. 1. Caligus parvus, ♀, sp. n., enlarged.

1 a. Under surface of cephalothorax. 1 b. Last joint of first peræopod. 1 c, d. Second and third peræopods. 1 e. Caudal plate.

Fig. 2. Male of same.

2 a. Anterior portion of cephalothorax. 2 b. Hamulus. 2 c. Posterior antennæ. 2 d. Last joint of first maxilliped. 2 f. Second maxilliped.

Fig. 3. *Caligus cybii*, ♀, sp. n., enlarged.

3 a. Anterior portion of cephalothorax. 3 b. Furcula. 3 c. First peræopod. 3 d, e, f. Second, third, and fourth peræopods. 3 h. Caudal plate.

PLATE III.

Fig. 1. *Caligus hirsutus*, ♀, enlarged.

1 a. Anterior portion of cephalothorax. 1 b. Furcula. 1 c. Last joint of fourth peræopod, highly magnified. 1 d. Caudal plate.

Fig. 2. Male of same, enlarged.

Fig. 3. *Caligus Phipsoni*, ♀, sp. n., enlarged.

3 a. Anterior portion of cephalothorax. 3 b. Caudal plate. 3 c. Second maxilliped. 3 d. Fourth peræopod. 3 e. Furcula.

Fig. 4. Male of same.

PLATE IV.

Fig. 1. *Caligus longicaudus*, ♀, sp. n., enlarged.

1 a. Cephalothorax from beneath. 1 b. Furcula. 1 c. Fourth peræopod. 1 d. Angle of genital segment and fifth peræopod. 1 e. Caudal plate. 1 f. Third peræopod.

Fig. 2. Male of same.

2 b. Second antennæ. 2 c. Second maxilliped.

Fig. 3. *Caligus (Sciænoophilus) Benedeni*, ♀.

3 a. Cephalothorax from below. 3 b. Fourth peræopod. 3 c. Caudal plates. 3 d. Second maxilliped.

PLATE V.

Fig. 1. *Helleria armata*, ♀, gen. et sp. n.

1 a. Cephalothorax from beneath, much enlarged. 1 b. Seen from the side. 1 c. Margin of second maxilliped. 1 d. Mouth-organs. 1 e, f, g. First, second, and third peræopods. 1 h. Anterior antennæ, much enlarged.

Fig. 2. Male of same.

2 a. Cephalothorax from beneath, much magnified. 2 b. Caudal extremity. 2 c. Caudal appendage. 2 d. Second antennæ, terminal joint. 2 f. Lower lip and one of the styles.

PLATE VI.

Fig. 1. *Brachiella appendiculosa*, ♀, much enlarged, seen from side.

1 a. Organ of adhesion.

Fig. 2. Ditto, seen from underneath.

Fig. 3. Male of same.

3 a. Mouth-organs. 3 b. Antennæ. 3 c, d. First and second maxillipeds.

Fig. 4. *Chondracanthus elongatus*, ♀, much enlarged, from underneath.

Fig. 5. Ditto, seen from side.

Fig. 6. Male of same, highly magnified.

6 a, b. First and second maxillipeds.

PLATE VII.

- Fig. 1. *Lernæonema polynemi*, ♀, enlarged.
 1 a. Cephalothorax in young specimen, showing antennæ &c.
 1 b. Second peræopod. 1 c. Fourth peræopod. 1 d. Posterior antennæ.
 Fig. 2. *Peroderma branchiata*, ♀, sp. n., enlarged.
 2 a. Tentacular processes, much enlarged.
 Fig. 3. *Lernanthropus trifolius*, ♀, sp. n., from underneath.
 3 a. Seen from the side. 3 b. Under view of head from beneath.
 3 c. Seen from the back. 3 d. Anterior antennæ, much magnified.

N.B.—Fourth peræopod on right side of *B. tricerus* in Plate I. fig. 1 a is drawn much too large.

II.—On the Respiration of *Carcinus mænas*, Leach *.

By GEORGES BOHN †.

THE common shore-crab (*Carcinus mænas*), which is so abundant on our coasts, especially on the shores of Normandy, where it is called the *furious crab* ("*Crabes enragés*"), and where I have just been observing it daily for more than a month, exists, as all are aware, under very varied conditions. Some individuals bury themselves more or less in the mud; at low tide they are to be found hidden under stones or sunk in the sand; on the beach they run with rapidity, living as much in the air as in the water; in laboratories they are kept alive for very long periods in crystallizing-pans: I have seen some which have lasted more than a month in water which was not changed, surrounded by dead animals and rotten seaweeds.

While investigating the influence of the habitat upon the respiration of this crab, I have been led to observe a curious phenomenon, which, so far as I am aware, has not hitherto been described by anyone. I refer to the faculty of reversing for a longer or shorter period the direction of the circulation of the water in the branchial chamber.

Since the memorable observations of Audouin and Milne-Edwards upon *Maia* and the "great" crabs of our shores everyone has always followed these authors in stating that the water enters by a particular point situated in front of the anterior legs, and traverses the branchial chamber from

* A study carried out at the marine laboratory of the Muséum at Saint-Vaast-la-Hougue.

† From the 'Comptes Rendus,' t. cxxv. no. 11 (September 13, 1897), pp. 441-444.

behind forwards, to issue by orifices situated on the anterior margin of the buccal framework, and that the current is occasioned by the scaphognathite of the jaw *. In fact, this is what is observed under ordinary conditions in crabs. In *Carcinus mænas*, in consequence of a modification of the movements of the scaphognathite, the direction of the current may undergo a change †.

The observation may easily be repeated. All that is necessary is to place a crab in a crystallizing-pan containing just sufficient water to cover it; as a rule the crab quickly raises itself on the posterior part of its body in such a way as to cause its front and the so-called *expiratory* orifices to emerge. Then the water is sometimes seen to continue to issue by these orifices; sometimes, on the contrary—and this occasionally during long periods of time—bubbles of air pass out in a continuous fashion from the so-called *inspiratory* orifices which have become expiratory: the air naturally enters by the orifices raised above the water. During this latter period the epipodites may remain motionless, and I have succeeded in observing the movement of the scaphognathite undergo a modification. Thus, then, through the instrumentality of the scaphognathite, a direct circulation of water is succeeded by an inverse circulation of air. Without doubt a portion of the oxygen in the air is absorbed just as it is, while another portion is dissolved in the water still contained in the branchial cavity.

The experiment succeeds all the better when the crab is immersed in water which is less fit for respiration. The reversal of the circulation of the water has a notable physiological advantage for the animal: instead of fatiguing itself to no purpose in causing the circulation in the branchial chamber of water which is badly aerated, or in any way insufficient for respiration, it utilizes the energy of the motor muscles of the scaphognathite in making air penetrate into the branchial chamber, to aerate the water which bathes its gills.

In the natural state the advantages of the reversal often make themselves felt. When, for example, the crab lives upon a muddy bottom, it can absorb air instead of muddy water, which would clog its gills with slime, or, at any rate, can take in water from the surface, which is always purer than that in the depths. I have reproduced these conditions

* Haan alone maintained the contrary—that is to say, that in the branchial chamber the current passed from the front to the rear; and a year ago Mr. Garstang, of Oxford, frankly said that he was mistaken.

† Which explains the observation of Haan.

experimentally, and have proved that this is the case by mixing carmine with the water in order to show the respiratory currents.

Now here are facts that remind us of the phenomena which take place in the case of *Corystes*, the crab which buries itself in the sand during the day, and the mechanism of whose respiration was recently the subject of a pleasing memoir by Mr. Garstang, of Oxford; the reversal, says the author, takes place during the day—that is to say, when the crab is buried. Mr. Garstang did not seek the reason of this reversal, and left the fact isolated, without explanation. The physiological explanation that I have just given with reference to *Carcinus mænas* evidently applies to *Corystes*. I would add that the act of reversal is not peculiar to these two species of crabs; everywhere where I have sought for it among crabs I have found it—in *Portunus*, where, as in *Carcinus*, there is a medium amount of differentiation, and in *Hya* or *Maia*, which are so highly specialized and have a mode of life so different from the foregoing; in the case of these latter examples the periods of reversal never last longer than a few seconds*. Since in this instance the reversal cannot be explained by the mode of life, I sought for the origin of it among the ancestors of the crabs or their near relations. I have observed it in *Palæmon*, as also in the *Megalopa*-larvæ and in the crayfish. When a prawn is placed in water charged with carmine, from time to time jets of water are seen to issue from the inferior margin of the carapace, from the spot at which inspiration usually takes place; at these moments, owing to the reversal of the movement of the scaphognathite, there occurs, within the branchial chamber, a regular rush of water from the front to the rear, which ejects all the foreign bodies with which it is encumbered. The same thing happens in the case of the crayfish. The reversal of the circulation of the water is therefore phylogenetically a very ancient fact, and it should be met with in the Peneidæ, just as in the prawns and lobsters, their descendants; in the natant, as in the ambulant, forms the reversal has no other object than to produce currents of water in a direction opposite to that of the normal stream, in order to cleanse the branchial chamber. In the case of crabs like *Maia*, where the cleansing process is performed by means of other mechanical arrangements, the reversal is met with again as a survival ("comme un souvenir ancestral"), but in the

* But in none of these crabs does the reversal of the motion of the scaphognathite produce spontaneously the entrance of air into the branchial chamber.

fossorial forms, i. e. *Corystes* and certainly others besides, the reversal of the circulation becomes, on the contrary, accentuated, and renders possible the adaptation of the ambulant forms to this new mode of life. In the case of *Carcinus mœnas* it enables the animal to live amid unwholesome surroundings by the introduction into the branchial chamber of air at a pressure even higher than that of the atmosphere*.

III.—On the Reversal of the Respiratory Current in the Decapods †. By GEORGES BOHN ‡.

THE reversal of the current of water in the branchial chamber, which has long been known in the case of *Corystes* and was recently described by me in *Carcinus mœnas*, Leach, and a certain number of other Decapods §, appears to be a phenomenon of absolutely general occurrence in this group of Crustacea. Mr. Garstang lately published an account of it in *Portunus nasutus*, Latr., and I have just proved its existence in twenty-one other species selected from the various families ||. I thought it would be interesting to note the frequency and the duration of the inversions in the different cases, and I now give the principal results that I have obtained.

The frequency of the inversions varies little from one type to the other: most frequently they occur at the rate of two per minute; in one and the same species the number appears to diminish in proportion as the size increases; thus, in the case of *Carcinus mœnas* there are on the average ten inversions

* The occurrence of this reversal appeared to me to have its bearing on the comprehension of the adaptations that are found in the Decapods; M. Bouvier, who has lavished his learned advice upon me in the course of my investigations upon this group, of which he has so wonderful a knowledge, pointed out a fact of the same kind a few years ago. He explained the adaptation of these crustaceans to terrestrial life as being due to an ancestral anatomical and physiological condition—to wit, the *supplementary circulatory system* (the special circulation of the carapace).

† A study carried out at the marine laboratory of the Muséum at Saint-Vaast-la-Hougue.

‡ From the 'Comptes Rendus,' t. cxxv. no. 15 (October 11, 1897), pp. 539-542.

§ 'Comptes Rendus,' Sept. 13, 1897, pp. 441-444; *vide supra*, p. 17.

|| I propose to return later on to the mechanism of the process of reversal; at present I will simply say that the principal rôle seems to devolve upon the scaphognathite, and that in certain types the carapace intervenes; as for the cleansing organs (epipodites of the crabs, posterior limbs in *Galathea*, &c.); I have proved that they do not take any part in it.

in the *Megalopa*-larva, and in the course of growth this number diminishes progressively until it sinks to one.

The *duration* of the inversions is often very brief—about the hundredth part of a minute; but in a certain number of species, such as *Carcinus mænas*, it may be much greater than this. I have established in the case of each species the following number—to wit, the duration of the inverse circulation in the space of ten minutes—counted in hundredths of a minute *, and the results of my investigations are summarized in the appended table (p. 22).

In consequence of Prof. Giard having pointed out to me the importance of the phenomenon of reversal for the comprehension of the ethology of the parasitic forms, I was led to establish the following curious parallelism.

We know that the crustacean branchial parasites of Decapods are the Entoniscidæ, *Cepon*, *Bopyrus* (sensu stricto), and a few Copepods.

Entoniscidæ, the ethology of which has been so admirably elucidated by MM. Giard and Bonnier, have frequently been met with upon a *Porcellana* found upon the shores of Brazil, in *Carcinus mænas*, and in *Portumnus latipes*, Penn., which lies buried in the sandbanks on the shore at Wimereux. Now *Carcinus mænas* and *Porcellana longicornis* (which also has its Entoniscid) are the only species—species not related moreover—in which I have found for the inverse circulation a number most nearly approaching 500 (that is to say, 5 minutes in 10). *Portumnus latipes* is nearly allied to *Portumnus nasutus*, in which the reversal, as described by Mr. Garstang, is so strongly accentuated. In *Portunus*, *P. arcuatus* is apparently the only species able to exhibit periods of reversal of fairly long duration. Now this species is infested with Entoniscidæ much more frequently than *P. ruber* and *P. holsatus*. Among the Oxyrhyncha, *Achæus*—a genus allied to *Stenorhynchus*—is the only one that has been found to support an Entoniscid. In *Pilumnus hirtellus* these parasites are equally rare. Thus, except the latter, all the hosts mentioned † belong to the third category of the table.

Cepon, as M. Giard caused me to observe, is not met with

* This number, which is necessarily approximate, corresponds to the issue of carmine from the region of the latero-posterior inspiratory cleft of the carapace, which is the easiest to observe—that is to say, the one which is situated in front of the first thoracic limb. I have taken the hundredth of a minute, since it frequently corresponds to a beat of the scaphognathite, which I am therefore able to use as a metronome.

† I have passed over *Xantho* and the Grapsidæ, which I have not yet studied.

DURATION OF THE INVERSE CIRCULATION.	MACRURA.	ANOMURA.	BRACHYURA.
I. More than 10.	Lobster. Crayfish.	<i>Pagurus Bernhardus</i> , Fabr.	<i>Cancer pagurus</i> , Bell.
II. From 10 to 30	<i>Orangon vulgaris</i> , Fabr. <i>Alpheus ruber</i> , Edw. <i>Palæmon</i> . <i>Hippolyte</i>	<i>Galathea squamifera</i> , Leach. <i>Gebia deltaica</i> , Leach. <i>Callinassa subterranea</i> , Leach.	<i>Hyas araneus</i> , Leach. <i>Maia squinado</i> , Latr. <i>Pilumnus hirtellus</i> , Leach. <i>Stenorhynchus phalangium</i> , Edw. <i>Portunus puber</i> , Leach. <i>Portunus arcuatus</i> , Leach (120 and over). <i>Carcinus maenas</i> , Leach (60 to 200).
III. In which it may be more than 30, and even 100 (<i>i. e.</i> 1 minute in 10).	<i>Porcellana longicornis</i> , Edw. (60 to 200).	<i>Portunus nasutus</i> , Latr. <i>Corysles cassidulatus</i> , Penn.
IV. In which it may be more than 900	

in *Carcinus mænas*, in which the reversal is pronounced, nor in *Portumnus latipes* and *Porcellana longicornis*; but it is found in *Portunus arcuatus* and *Pilumnus hirtellus*, which belong to categories III. and II. of the table. *Callianassa*, which is included in the latter category, is infested with *Ionidæ* allied to *Cepon*.

Bopyrus, properly so called, is partial to the species of *Pulæmon*, *Hippolyte*, and *Galathea*, belonging to category II.

Copepods are rare: they have been met with only in a few examples of *Hippolyte* and in the lobster. Excluding this latter and a few rare exceptions*, the extreme categories of the table comprise only species which are without branchial parasites.

I have attempted to account for these facts, and it seems to me that the reversal alluded to has both disadvantages and advantages for the parasite.

An inverse current can always eject the parasite in the act of penetrating into the branchial cavity, just as it also expels any strange body whatever. The *Entoniscidæ* alone are able to penetrate in the case of the species in which the reversal is somewhat prolonged; *Cepon* and *Bopyrus* appear much more susceptible in this respect.

But an inverse current, while it cleanses the branchial chamber, causes to pass through it a much more highly oxygenated stream of water, for it is more rapid and the water has not time to charge itself (especially from the well-developed posterior gills) with carbonic anhydride. Here there is an advantage for the parasite; but in the case of the *Entoniscidæ*, in which the respiratory mechanism has been discovered by M. Giard, the advantage is more apparent. In the midst of the animal's viscera the parasite occupies a chamber which is in communication with the branchial cavity of the host by means of a narrow orifice; in consequence of the movements of the abdominal appendages of the parasite the water is drawn in and driven out again alternately. Now in the branchial cavity of the host, which from time to time reverses the circulation of the water, there is a similar alternation: to the inverse current corresponds an increase of pressure of the water in this cavity, which forces the liquid to penetrate into the chamber of the parasite; to the direct current there corresponds, on the contrary, a diminution of pressure, which assists the parasite's expiration.

* *Pagurus Bernhardus* is infested with a *Palæogyge*, but it is true the latter is very rare.

IV.—*Descriptions of Ten new Species of Terrestrial Mollusca from South Africa.* By JAMES COSMO MELVILL, M.A., F.L.S., and JOHN HENRY PONSONBY, F.Z.S.

[Plate VIII.]

SINCE our last paper * on the subject we have received several shells which appear to be hitherto undescribed. To one of these—a *Dorcasia*—we would direct special attention, on account of its remarkable characters. Amongst the novelties are several interesting *Enneæ*, and as in so critical a genus it is imperative that all the species should be figured, we have pleasure in including a figure of *E. consobrina*, Ancey (see Brit. Naturalist, 1892, p. 125), acknowledging at the same time our indebtedness to Mr. Brockton Tomlin, who has kindly entrusted us with his type specimen for the purpose.

Natalina cafferula, sp. n. (Pl. VIII. fig. 1.)

N. testa depresso-conica, tenui, late et profunde umbilicata, supra parum nitente, sed subtus corusca, corneo-olivacea; anfractibus quinque, ventricosulis, undique superne striis obliquis longitudinaliter decoratis, ultimo rapide accrescente, striis infra medium evanidis; apertura ovato-lunari; peristomate tenui, simplici.

Diam. max. $11\frac{1}{2}$, min. $9\frac{1}{2}$; alt. $5\frac{1}{2}$ mm.

Hab. Knysna.

An interesting species, depressedly conical, thin, widely and deeply umbilicate, basally shining, horny-olivaceous in colour; five-whorled, the whorls slightly ventricose, ornamented above with longitudinal oblique striæ; the last whorl increases rapidly; below the middle the striæ become obsolete; the aperture is ovate-lunar; peristome thin, simple. The specific name is suggested by the resemblance of the shell to that of a diminutive *N. caffer*, Fér.

Ennea caryatis †, sp. n. (Pl. VIII. fig. 2.)

E. testa parva, recta, cylindriformi, tenuissima, albedo-pellucida, apice obtuso; anfractibus septem, apud suturas distincte impressis, vitreis, undique longitudinaliter striatulis, striis apud medium evanescentibus, infra lævibus, anfractu ultimo paullum producto, fere lævi; apertura rotundo-ovata; peristomate albo, pellucido, incrassato, dentibus plicisve quatuor instructo, plica

* Ann. & Mag. Nat. Hist. (6) vol. xix. p. 633.

† *καρύατις*, in architecture, an ornamental pillar.

parietali acinaciformi, intrante, dente labiali permagno, basali parvo, plica columellari dentiformi, valde intrante.
Long. 3·50, lat. 1 mm.

Hab. "S. Africa" (*Farguhar*).

Nearly allied to *E. cimolia* and *E. Margaretta*, M. & P.* From the first-named it differs in its slightly smaller size and in the whorls being partially longitudinally striate, *E. cimolia* being completely smooth; the mouth-processes are likewise different, that species possessing only three teeth or plaits, whilst *E. caryatis* has a basal tooth as well. From *E. Margaretta* it differs chiefly in the comparatively slight sinuosity of the outer lip, whilst the whorls in the last-named species are *completely* covered with fine longitudinal oblique striæ.

This pretty little *Ennea* was kindly presented to us for description by Mr. T. Rogers, of Manchester.

Ennea auris leporis †, sp. n. (Pl. VIII. fig. 3.)

E. testa crassiuscula, rimata, obesa, dolioliformi, cinerea: anfractibus septem, ad suturas paullum impressis, undique longitudinaliter obliqui-striatis, striis rudibus, crassiusculis; apertura trigonali; peristomate albo, incrassato, nitido, aurito, postice scrobiculato, intus multiplicato, plica parietali conspicua, acinaciformi, valde intrante, labiali dentiformi, profunde interna, plica basali simul ac columellari internis; fauce ima dentibus quinque vel sex contiguis, omnino internis, contra aperturam appositis, obstructa.
Long. 7, lat. 2·50 mm.

Hab. Natal.

A very distinct form, stout, tun-shaped, with obtuse apex, coarsely obliquely striate; mouth triangular, almost closed by the contiguous plaits and teeth. These are four in number: the parietal plait is conspicuous, the labial tooth-shaped, both, with the basal and columellar, are deep-seated and produced far down the throat, whilst five or six teeth are deep-seated at the base of the last whorl.

Ennea cionis ‡, sp. n. (Pl. VIII. fig. 4.)

E. testa cylindriciformi, obtusa, semipellucida, pallide straminea; anfractibus, apicali incluso, septem, supremis tumidulis, penultimo et ultimo rectis, undique longitudinaliter obliqui-striatis, striis delicatulis, nitidis; apertura ovato-trigonali; peristomate incrassato, albo, nitido, plicis vel dentibus quinque instructo,

* Ann. & Mag. Nat. Hist. (6) vol. xvi. pp. 478, 479.

† *auris leporis*, hare's ear, from the shape of the peristome.

‡ *cionis*, dim. of *κίων*, a pillar.

plica parietali permagna, acinaciformi, dente labiali bifido, dente basali acuto, parvo, plica columellari magna, nitida, valde intrante.

Long. 4, lat. 1.75 mm.

Hab. Port Elizabeth (*Crawford*).

A cylindriform columnar little *Ennea*, possessing many of the familiar characteristics of the genus, in being of a pale straw-colour, seven-whorled, including the obtuse apical whorl; upper whorls slightly ventricose, the last two straight; peristome shining white, thickened, furnished with the following plaits or teeth:—a very large parietal plait, externally prominent, scimitar-shaped; a bifid labial and a small acute basal tooth; and a large columellar process, deep-seated, yet almost reaching the outer lip.

Next *E. vanstaadensis*, M. & P., but stouter and not so elongate.

Several specimens.

Ennea Crawfordi, sp. n. (Pl. VIII. fig. 5.)

E. testa parva, brevi, dolioliformi, apice perobtusos, pallide cinereo-straminea, tenui; anfractibus sex, ad suturas impressis, ventricosis, primis tumidoribus, cæteris rectis, undique longitudinaliter oblique rudi-striatis; apertura trigono-rotunda; peristomate albo, nitido, incrassato, plicis dentibusve quatuor munito, plica parietali acinaciformi, tenui, intrante, dente labiali magno, acuto, basali minore, plica columellari interna, mammæformi.

Long. 3.50, lat. 1.40 mm.

Hab. Port Elizabeth (*Crawford*).

Four specimens of an interesting small species, which, while possessing no specially marked characteristics, we find ourselves unable to match with any yet described. It is small, short, cylindriform, with extremely obtuse apex, thin, six-whorled, impressed at the sutures; upper whorls somewhat tumid, while the lower are straight, all longitudinally rudely striate; peristome thickened, white, furnished with the following plaits or teeth:—a thin scimitar-shaped parietal plait, a large acute labial tooth, the basal being also acute but smaller, while the internal columellar process is nipple-shaped, deep-seated.

We have much pleasure in associating with this little species the name of Mr. J. Crawford; from whom we have received so much interesting material.

Ennea Rogersi, sp. n. (Pl. VIII. fig. 6.)

E. testa rimata, crassiuscula, apice obtusissimo, breviter cylindriciformi; anfractibus septem, paullum tumidis, ad suturas impressis,

undique longitudinaliter crassi-striatis, quatuor ultimis rectis, inter se similibus; apertura rotundo-lunari; peristomate circulari, plicis vel dentibus duobus solum munito, plica parietali acuta, acinaciformi, valde intrante, dente labiali acuto, parvo, margine columellari infra paululum incrassato, simplici.

Long. 5, lat. 2 mm.

Hab. "Cradock Comonage, S. Africa" (e coll. T. Rogers).

In its mouth-processes this *Ennea* resembles *E. Collieri*, M. & P., but not in form, texture, or any other particular. It is also comparable with *E. crassilabris*, Craven, which species is very much larger in all its parts.

Though small, it is an attractive and very beautiful species, columnar, seven-whorled, the last four being uniform and straight; the peristome is circular, furnished with one parietal plait, large and deep-seated, one labial tooth likewise, while the columellar margin is to some extent callous and thickened below.

We have pleasure in connecting with this species the name of Mr. Thomas Rogers, of Oldham Road, Manchester, from whom we received it. We believe it was collected by Mr. Farquhar.

*Ennea dokimasta**, sp. n. (Pl. VIII. fig. 7.)

E. testa compacta, brevi, cylindracea, apice obtusissimo, pallide straminea, nitida; anfractibus septem, apud suturas compressis, undique longitudinaliter oblique striatis, striis comptis, arctis; apertura rotunda; peristomate semilunari, extus incrassato, stramineo, intus albescente, plicis vel dentibus quinque munito, plica parietali permagna, dentibus labialibus duobus, ordinariis, dente basali parvo, plica columellari interna, magna, valde intrante.

Long. 5, lat. 2.50 mm.

Hab. Natal.

A remarkably short cylindraceous *Ennea*, with very obtuse apex, straw-coloured, seven-whorled, longitudinally neatly and closely striate; the outer lip is roundly semilunar, thickened, without straw-coloured, within shining white, furnished with five plaits or teeth; of these the parietal plait is extremely large and protruded, the two labial and the basal teeth are normal, the columellar plait is very distinct, being unusually developed, internal, and deep-seated.

We have seen few, if any, species of this genus with so conspicuous a parietal plait or possessing the same characteristics as to the columellar process, which is not mammi-

* δοκίματος, tried, proved.

form at all, as is the case in *E. thelodonta* and other allied forms.

We received the above from Mr. Robert Cairns, of Ashton-under-Lyne.

Ennea eximia *, sp. n. (Pl. VIII. fig. 8.)

H. testa obesa, cylindræa, apice obtusissimo, semipellucida, albida vel pallide straminea; anfractibus octo, ad suturas impressis, paullum tumidulis, undique longitudinaliter oblique pulcherrime filo-striatis; apertura lunari; peristomate albido, nitido, incrassato, dentibus vel plicis quatuor instructo, plica parietali intrante, huic proximo parvo dente labiali, et. versus basin, altero dente labiali, in uno specimine bifido, plica columellari interna, valde intrante, planiuscula.

Long. 9, lat. 4 mm.

Hab. Between Delagoa Bay and Barberton, Transvaal.

A large and conspicuous as well as remarkably beautiful species. It is whitish or pale straw-coloured, cylindraceous, stout, eight-whorled, the apex and apical whorls being exceedingly obtuse, longitudinally uniformly most evenly filostriate; the aperture is lunar; peristome white, thickened, with the following teeth or plaits:—a parietal thin, deep-seated; two labial, one close to the parietal plait and very small, the other larger, towards the basal region, and in one specimen bifid; the columellar plait is wholly internal, deep-seated, and flattened.

Two specimens.

DORCASIA, Gray.

§ *TULBAGHINIA*, subgen. nov.

Shell as in typical *Dorcasia*, excepting in the possession of three contiguous teeth, more or less well developed on the inner base of the peristome.

Dorcasia (Tulbaghinia) isomerioides, sp. n.
(Pl. VIII. fig. 10.)

D. testa depresso-orbiculari, profunde umbilicata, umbilico infundibuliformi, solidiuscula, albida, epidermide olivaceo-brunnea connecta, spira subconica, apice ipso planato; anfractibus quinque, ultimo rapide accrescente, undique longitudinaliter obliqui-striatis, striis rudibus inæqualibus; apertura obliqua, ovata, intus brunneo-cinerea; peristomate nitido, albo, fere continuo, paullum extus incrassato, reflexo, supra umbilicum dilatante, dentibus tribus parvis contiguis basalibus prædito.

Diam. max. $29\frac{1}{2}$, min. 25; alt. 12 mm.

Hab. Winterhock Mountains, Tulbagh district.

† *Eximius*. choice.

Whilst in general form allied to *D. lucana*, Müll., and others of that section, so typical of the South-African fauna, this extraordinary shell, in the possession of three short contiguous basal peristomatal teeth, recalls the species of the South-American genus *Isomeria*. Nothing like this has before occurred in Africa; and we should have treated the discovery of one specimen alone, exhibiting such peculiarities, as a probable sport or monstrosity, but three examples occurred. One of these, whose teeth, though very distinct, were not quite so pronounced as those of the example selected for the type, was transversely banded with dark brown round the centre of the last whorl.

We have considered it desirable to institute a subgeneric name for this new form, and have suggested *Tulbaghinia*, from the district where it was found.

Achatina rhabdota *, sp. n. (Pl. VIII. fig. 11.)

A. testa mediocri, ovato-oblonga, tenui, ochraceo-straminea, apice obtuso; anfractibus septem, supernis decussato-granulosis, ultimo ad medium simili modo granuloso, infra, usque ad basin, lævi, nitido, undique flammis zebrinis longitudinaliter decoratis, ultimo prolongato; apertura oblonga; peristomate tenui, simplici, margine columellari ad basin truncato.

Long. 45, lat. 20 mm.

Hab. "South Africa."

In form resembling *A. ustulata*, Lam., though not quite so elongate; in marking like a miniature *A. zebra*, L. It does not seem to be a young shell, and we hardly conjecture that the species will be found to attain greater dimensions than that of the type before us.

It is handsome, painted with longitudinal close-lying zebrine flames, dark brown on a straw-coloured ground, the whole surface of the upper whorls and the upper portion of the last being delicately decussately granulose.

EXPLANATION OF PLATE VIII.

Fig. 1. *Natalina caffrula*.
Fig. 2. *Ennea caryatis*.
Fig. 3. — *auris leporis*.
Fig. 4. — *cionis*.
Fig. 5. — *Crawfordi*.
Fig. 6. — *Rogersi*.

Fig. 7. *Ennea dokimasta*.
Fig. 8. — *eximia*.
Fig. 9. — *consobrina*, Ancey.
Fig. 10. *Dorcasia* (§ *Tulbaghinia*)
isomerioides.
Fig. 11. *Achatina rhabdota*.

* *ῥάβδος*, zebra-striped.

V.—Notes on Indian Snakes in Captivity.

Communicated by Dr. GÜNTHER.

OBSERVATIONS on living tropical snakes are so scarce that the following notes, which appeared in the 'Administration Report of the Madras Government Museum for the year 1896-97' (an official document not generally accessible to zoologists), seem to deserve to be brought to the notice of a wider circle of herpetologists.

Although the observations were made on specimens kept in captivity in the Madras Museum, they are of value, as the snakes are living under more natural climatic conditions than those kept in the zoological gardens of Europe. The observations cover the financial year from 1st April, 1896, to 31st March, 1897.

"Python (*Python molurus*) ate 59 jerboa rats (*Gerbillus indicus*), 2 quails, and 8 squirrels in the year. Shed its skin on the 12th April, 2nd July, and 17th December, 1896.

"Rat-snake (*Zamenis mucosus*) ate 135 green frogs in the year. Shed its skin 22nd April, 18th May, 15th June, 8th July, 5th August, 5th September, 5th October, 7th November, 14th December, 1896, 17th January and 27th February, 1897, *i. e.* in every month.

"Whip-snake (*Dryophis mycterizans*).—One lived up to 11th December, 1896, and ate 44 mice and 6 green frogs and toads. A new snake was procured on the 31st January, 1897, which ate only 1 mouse up to the end of the official year. The first one cast its skin on the 28th May, 9th August, and 25th October, 1896, *i. e.* in every three months.

"Sand-snake (*Eryx Johnii*) ate 17 rats in the year. Cast its skin on the 24th April, 28th June, 18th September, 1896, and 14th January, 1897.

"Sand-snake (*Gongylophis conicus*) ate 65 rats in the year. Cast its skin on the 30th April, 4th June, 22nd July, and 4th October, 1896.

"*Tropidonotus stolatus* ate 130 frogs. Cast its skin on the 28th June, 6th July, 27th July, 3rd September, 14th December, 1896, 18th January and 27th February, 1897. Laid one egg on the 17th August, one on the 20th August, two on the 22nd August, three on the 12th September, three on the 14th September, one on the 15th September, and three on the 18th September, 1896.

"Krait (*Bungarus cœruleus*).—One krait ate 2 frogs from the 11th to 16th October, 1896, and then died; another was

secured on the 7th November, which ate 18 frogs, cast its skin on the 7th December, 1896, 13th January and 27th February, 1897.

"Tree-snake (*Dendrophis pictus*) ate 94 frogs up to 21st January, and died on the 22nd January. Cast its skin on the 2nd April, 6th May, 23th June, 27th July, and 29th October. A second specimen was procured on the 13th February, which ate 18 frogs.

"Russell's viper (*Vipera Russellii*), young, ate 67 mice, 2 small rats, 5 squirrels, and 4 frogs. Cast its skin on the 16th June, 31st July, 6th October, and 27th December, 1896.

"Russell's viper (*Vipera Russellii*) ate 27 rats and 5 squirrels. Cast its skin only once, *i. e.* 17th November, 1896.

"*Echis carinata*.—Two specimens were exhibited on the 29th October, and have up to date eaten only 8 frogs.

"The two aquatic snakes added were *Tropidonotus quincunciatus* and *Atrretium schistosum*; the latter is called in Tamil 'Neer nagan,' *i. e.* water cobra, from its power of dilating its head. Both the snakes eat frogs and fishes. *Tropidonotus* laid 36 eggs on the 26th February, 1897."

VI.—Notes on the Cubomedusæ.

By F. S. CONANT*.

IN June and July of 1896, while the Marine Biological Laboratory was stationed at Port Henderson, in Kingston Harbour, Jamaica, two species of Cubomedusæ were found in unexpected abundance. Of these one was very much like the *Charybdea marsupialis* of the Mediterranean, the other presented characteristics midway between those of the Charybdeidæ and the Chirodropidæ—the two families into which Hæckel divides the Cubomedusæ—so that for it I have erected a new family under the name of the Tripedalidæ. The names that have been chosen for the two Jamaica forms are *Charybdea xaymacana* and *Tripedalia cystophora*.

A.—SYSTEMATIC.

Hæckel's classification, as given in his 'System der Medusen,' is as follows:—

* From the 'Johns Hopkins University Circulars,' November 1897, pp. 8-10.

CUBOMEDUSÆ (Hæckel, 1877).

Acraspeda with four perradial marginal bodies, which contain an auditory club with endodermal otolith-sac and one or several eyes. Four interradial tentacles or groups of tentacles. Stomach with four wide perradial rectangular pockets, which are separated by four long and narrow interradial septa. They belong to the subumbrella, and are developed from the endoderm of the stomach-pockets, so that they project freely into the space of the pockets.

Family I. Charybdeidæ (Gegenbaur, 1856).

Cubomedusæ with 4 simple interradial tentacles; without marginal lobes in the velarium, but with 8 marginal pockets; without pocket-arms in the 4 stomach-pockets.

Family II. Chirodropidæ (Hæckel, 1877).

Cubomedusæ with 4 interradial groups of tentacles; with 16 marginal pockets in the marginal lobes of the velarium, and with 8 pocket-arms, belonging to the exumbrella, in the 4 stomach-pockets.

(This family is represented in American waters by a species of *Chiropsalmus* found at Beaufort, N.C., and identified by H. V. Wilson as *Ch. quadrumana*. Before Claus's paper on *Charybdea marsupialis* was received at the laboratory, Professor Wilson had gone over precisely the same ground on *Chiropsalmus*, but with results so similar to those of Claus that, when the latter's article came, he did not finish for publication the notes and drawings he had made.)

To accommodate the second species found in Kingston Harbour another family must be added to the preceding.

Family III. Tripedalidæ (1897).

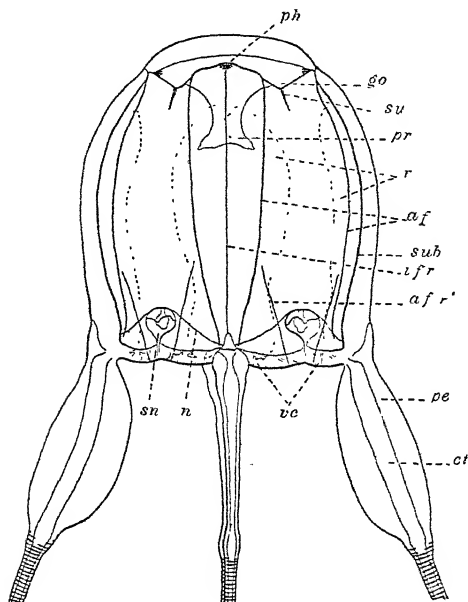
Cubomedusæ with 4 interradial groups of tentacles, each group having 3 tentacles carried by 3 distinct pedalia; without marginal lobes in the velarium; with 16 marginal pockets; without pocket-arms in the stomach-pockets.

Description of *Charybdea xaymacana*. (Fig. 1.)

Genus *Charybdea* (acc. to Hæckel): Charybdeidæ with 4 simple interradial tentacles, with pedalia; with velarium suspended, with velar canals and 4 perradial frenula. Stomach flat and low, without broad suspensoria. Four

horizontal groups of gastric filaments, simple or double, tuft- or brush-shaped, limited to the interradial corners of the stomach.

Fig. 1.

*Charybdea xaymacana.**Reference letters in Figures.*

af, furrow on inner surface of exumbrella underlying the adradial ridge on the outer surface; *af r'*, furrow on outer surface, setting off the area in which the sensory niche lies; *ct*, canal of the tentacle; *go*, gastric ostium; *ifr*, interradian furrow on outer surface; *n*, nerving on the subumbrella; *pe*, pedalium; *ph*, phacellus; *pr*, proboscis; *r*, reproductive organ; *sn*, sensory niche; *su*, suspensorium; *sub* subumbrella; *vc*, velar canals.

Species: *Charybdea xaymacana*.

Bell a four-sided pyramid, with the corners more rounded than angular, yet not so rounded as to make the umbrella bell-shaped. The sides of the pyramid parallel in the lower two thirds of the bell, in the upper third curving inward to form the truncation; near the top a slight horizontal constriction. Stomach flat and shallow. Proboscis with four

oral lobes, hanging down in bell-cavity a distance of between one third and one half the height of bell; very sensitive and contractile, so that it can even be inverted into the stomach. The four phacelli, epaulette-shaped, springing from a single stalk. Distance of the sensory clubs from the bell-margin one seventh or one eighth the height of bell. Velarium in breadth about one seventh the diameter of the bell at its margin. Four velar canals in each quadrant; each canal forked at the ends, at times with more than two branches. Pedalia flat, scalpel-shaped, between one third and one half as long as the height of bell. The four tentacles, when extended, at least eight times longer than the bell. Sexes separate. Height of bell 18-23 millim.; breadth about 15 millim. (individuals with mature reproductive elements). Without pigment. Found at Port Henderson, Kingston Harbour, Jamaica.

As may be seen from the above, *C. xaymacana* differs only a little from the *C. marsupialis* of the Mediterranean. Claus mentions in the latter a more or less well-defined asymmetry of the bell, which he connects with a supposed occasional attachment by the proboscis to algæ. In *C. xaymacana* I never noticed but that the bell was perfectly symmetrical. *C. xaymacana* is about two thirds the size given by Claus for his examples of *C. marsupialis*, which were not then sexually mature. It has 16 velar canals instead of 24 (32) as given by Hæckel, or 24 as figured by Claus. Difference in size and in number of velar canals are essentially the characteristics upon which Hæckel founded his 'Challenger' species *C. Murrayana*.

Description of *Tripedalia cystophora*. (Fig. 2.)

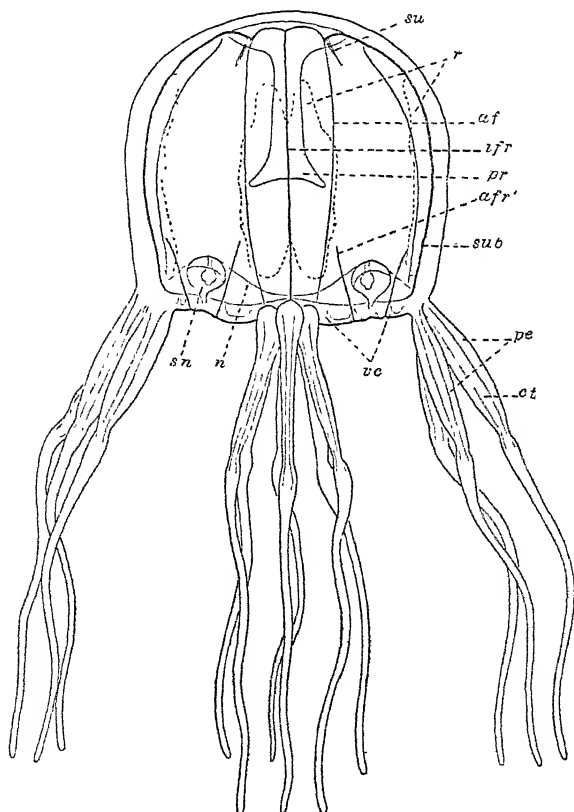
Genus *Tripedalia*: for the present the characteristics of family and genus must necessarily be for the most part the same. The genus is distinguished by having 12 tentacles, in 4 interradial groups of 3 each; velarium suspended by 4 per-radial frenula; canals in the velarium; stomach with relatively well-developed suspensoria; 4 horizontal groups of gastric filaments, each group brush-shaped, limited to the interradial corners of the stomach.

Species: *Tripedalia cystophora*.

Shape of bell almost exactly that of a cube with rounded edges; the roof but little arched. Proboscis with 4 oral lobes; hanging down in the bell-cavity generally more than

half the depth of the cavity, and at times even to the bell-margin. In the gelatine of the proboscis an irregular number (15-22) of sensory organs resembling otocysts, from the presence of which comes the specific name. Phacelli brush-shaped, composed of from 7 to 13 filaments springing from a

Fig. 2.

*Tripedalia cystophora.*

single stalk in each quadrant, or, rarely, from two separate stalks in one of the quadrants. Distance of the sensory clubs from the bell-margin about $\frac{1}{5}$ or $\frac{1}{4}$ of the height of bell. Breadth of velarium about $\frac{1}{6}$ the diameter of bell at margin; with 6 velar canals on each quadrant; the canals simple,

unforked. Pedalia flattened, shaped like a slender knife-blade, about half as long as the height of the bell. Tentacles at greatest extension observed $2\frac{1}{2}$ times the length of pedalia. Sexes separate. Height of bell in largest specimens (reproductive elements mature) 8 or 9 millim. Breadth same as height, or even greater. Colour a light yellowish brown, due in large part to eggs or embryos in the stomach-pockets. The reproductive organs especially prominent by reason of their similar colour. Found in Kingston Harbour, Jamaica.

It will be seen from the above that *Tripedalia* possesses two of the characteristics of the Charybdeidæ and two of the Chirodropidæ. The small size of *T. cystophora* is worthy of note in connexion with the fact that of the twenty species of Cubomedusæ given by Hæckel in his system only two are smaller than 20 millim. in height, and those are the two representatives of Hæckel's genus *Procharagma*, the prototype form of the Cubomedusæ, without pedalia and without velarium. While *Tripedalia* has both pedalia and velarium, it may be, perhaps, that its small size, taken in connexion with characteristics just about midway between the Charybdeidæ and the Chirodropidæ, indicate that it is not a recently acquired form of the Cubomedusæ.

B.—HABITAT.

The Cubomedusæ are generally believed to be inhabitants of deep water, which come to the surface only occasionally. Both of the Jamaica species, however, were found at the surface of shallow water near the shore, and only under these circumstances. Whether these were their natural conditions, or whether the two forms were driven by some chance from the deep ocean into the harbour, and there found their surroundings secondarily congenial, so to speak, can be a matter of conjecture only. *C. xaymacana* was taken regularly a few yards off-shore from a strip of sandy beach not ten minutes' row from the laboratory at Port Henderson. It was seen only in the morning before the sea-breeze came in to roughen the water and to turn the region of its placid feeding-ground into a dangerous lee-shore. Some of the specimens taken contained in the stomach small fish so disproportionately large in comparison with the stomach that they lay coiled up, head overlapping tail. The name *Charybdea*, then, meaning a gulf, rapacious, seems to be no misnomer. It is worth mentioning that the digestive juices left the nervous system of the fish intact, so that from the stomach of a *Charybdea* could be obtained beautiful dissections, or, rather, macerations, of the brain, cord, and lateral nerves of a small fish.

Charybdea is a strong and active swimmer, and presents a very beautiful appearance in its movements through the water. The quick vigorous pulsations contrast sharply with the sluggish contractions seen in most Scyphomedusæ. When an attempt is made to capture one it will often escape by going down into deeper water—as, indeed, do other jellyfish. Escape from observation is all the more easy by reason of the entire absence of pigment, except for the small amount in the sensory clubs. The yellowish or brownish colour usually stated as common in the Cubomedusæ is nowhere present in *C. xaymacana*.

The environment in which *Tripedalia* was found is still more unlike that in which Cubomedusæ have been taken heretofore. It was obtained in two localities, both of which were cut off from the main body of the harbour, and so from the ocean, by peninsulas and islands covered with a growth of mangrove. The water was shallow and discoloured with organic matter, and the bottom for the most part a black mud. The regions were virtually mangrove-swamps. It was under the shelter of the overhanging mangrove boughs, among their half-submerged roots, that the *Tripedalia* was found thriving in large numbers. Conditions more strikingly unlike those of the pure deep sea could hardly be imagined.

T. cystophora is as quick and vigorous a swimmer as the species of *Charybdea*. In one case as many as 110 pulsations were counted in a minute. Its brownish-yellow colour enables it to escape observation not infrequently in the discoloured water.

C.—ANATOMY.

An abundance of material of both species was preserved in several ways and has furnished subject-matter during the past year for investigation of the adult anatomy of the Cubomedusæ. The results have been embodied in a paper whose publication I hope will not be greatly deferred. Meanwhile the mention of one or two points may not be out of place.

The parts to which especial attention was given were the vascular lamellæ, or cathammal plates, and the nervous system. The vascular lamellæ, being definite areas where the two walls of the gastro-vascular system have come together and fused, are interesting because they show how the present structure of the gastro-vascular system of the Cubomedusæ has come about from a simpler undivided condition. It was hoped that their study might throw definite light on the affinities of the group. The results, however, were unsatisfactory, for while one part of the system of

lamellæ pointed strongly toward a relationship with such Hydromedusæ as, for example, *Liriope* (Trachomedusæ), another part, around the margin of the bell, gave evidence equally as good to the effect that the velarium was formed by the fusion of marginal lobes and that the view which considers it not homologous with the Hydromedusan velum is therefore correct. The question as to the affinities of the Cubomedusæ must wait until the development is known.

The nervous system has been described by Claus*, and more recently in greater detail by Schewiakoff†. With the latter's conclusions as to the structure of retina and vitreous body of the complex eyes on the sensory clubs I am unable to agree. Schewiakoff's conception of the structure is in brief as follows:—

a. The retina is made up of two types of cells, pigment and visual, which are figured as alternating regularly. The pigment-cells are cone-shaped; the visual are spindle-shaped, with their nuclei lying in the swollen central portion of the spindle at a lower level than the nuclei of the supporting pigment-cells.

b. From the visual cells extend rod-like processes into the vitreous body (which lies between the retina and lens), lying in canals in the vitreous body.

c. In the vitreous body separate cone-shaped streaks of pigment overlie the pigment-cells, which do not, however, form part of those cells.

d. Apart from these pigment-streaks and the rod-like processes of the visual cells, the vitreous body is structureless, probably a secretion of the pigment-cells.

The conclusions reached upon the same points by the study of the two Jamaica species are:—

a. There is not good evidence of two distinct types of cells in the retina—cone-shaped pigment-cells and spindle-shaped visual cells, with the nuclei of the latter at a lower level than those of the former.

b. The rod-like processes in the vitreous body exist, though not referable to a special type of cell in the retina.

c. The cone-shaped streaks of pigment in the vitreous body belong to the underlying pigment-cells, in fact are direct continuations of them, and at their distal ends they are prolonged into fibrous processes lying in canals of the vitreous body exactly like the visual rod-like processes of Schewiakoff.

* "Ueber *Charybdea marsupialis*," Arb. aus d. zool. Inst. d. Univ. Wien, Bd. ii. Heft 2 (1878).

† "Beiträge zur Kenntniss des Acalephenauges," Morph. Jahrb. Bd. xv. Heft 1 (1889).

d. The vitreous body, over and above these "visual fibres" and "pigment-streaks," is not a homogeneous secretion, but is composed of prisms of gelatinous refracting substance, each with a denser central fibre. The size of the cross-sections of these prisms corresponds with that of the cross-sections of the majority of retinal cells. It is probable, therefore, that they represent the outer ends of retinal cells.

From the above it will be seen that I find in the vitreous body two structures in addition to Schewiakoff's visual processes—namely, similar processes from the "pigment-streaks," and the prisms that make up the mass of the body. I am inclined to believe that the retina contains at any rate two, and perhaps three, kinds of cells, but that these are distinguishable only by that part of them which lies in the vitreous body, and are not distinguishable in the retina as two alternating types, as figured by Schewiakoff.

In another point also I am unable to agree with Schewiakoff. In one region of the sensory club is found a mass of peculiar large, closely packed, polygonal cells, which he affirms to be ganglion-cells, as against Claus, who considers them supporting cells. In my sections they show nothing whatever to suggest a resemblance to ganglion-cells. No processes could be made out, and the body of the cell consisted of a beautiful cytoplasmic reticulum with thickenings at the nodes of the rather coarse meshes.

The sensory organs in the proboscis of *Tripedalia* are simple cysts of ciliated epithelium lying in the gelatine. The long cilia support and keep in constant motion an otolith of ragged outline, in which no trace of cellular structure was found. This is the only case, so far as I know, of the occurrence among the Medusæ of a free unsuspended otolith in a ciliated sac.

D.—DEVELOPMENT.

Females of *Tripedalia* were found with stomach-pouches or pockets filled with developing ova, so that I am able to offer a few facts preliminarily on the development of the Cubomedusæ. The mature eggs pass from the ovaries into the stomach-pouches, and there develop up to the stage of free-swimming planulæ. In with them are found floating masses of cells, showing here and there a nematocyst, whose structure points clearly to an origin from the ovary also. These masses circulate about among the developing ova, and serve for protection and apparently also for nutrition, since the cells are found vacuolated in masses from individuals containing well-advanced embryos. All the eggs or embryos in one

individual are at the same stage of development. Gastrulation was not observed in the living material, but sections show a stage in which central cells lie clearly marked off from a surrounding ring of smaller surface-cells, and the probability is that these endodermal cells were formed by delamination. When the spherical mass is beginning to elongate into the ellipsoidal form of the planula a large migration of cells from the surface into the centre takes place, not limited to one pole. The relation of the central cells earlier seen and of these in-wandering cells to the definitive endoderm was not made out. The young are set free from the parent as ciliated planulæ, having pigment spots on the posterior end. The planulæ swim about actively on the surface for a day or two, their motion being both translation and rotation. Then they gradually lose the forward motion and rotate on their own axis in one spot. At this point they settle down and the pigment spots which were on the posterior surface are found to migrate into the interior. In a day or two they bud out two tentacles, and shortly afterwards two more, though young hydrazes with three and five tentacles were by no means uncommon. In this condition they lived for three weeks in the aquaria without undergoing further development.

Search for scyphistomas in the region where the jellyfish were found was fruitless. The youngest specimens taken in the tow were of practically the adult structure, so that the important intermediate stages remain unknown. The youngest jellyfish were interesting, however, in that only the middle tentacle in each group was developed, and that the sensory clubs were situated almost on the margin, and were not yet enclosed in niches.

VII.—*On new Mammals from Western Mexico and Lower California.* By OLDFIELD THOMAS.

THE British Museum has received from Mr. W. W. Price two collections of mammals—one from Sinaloa, W. Mexico, obtained by Mr. P. O. Simons, and the other from the Cape region of Lower California, collected by Mr. D. Coolidge.

In the former collection occur the remarkable pigmy skunk with uninterrupted dorsal lines (*Spilogale pygmaea**) exhibited recently at the Zoological Society, and the jaguarondi described below. The remainder of the collection consists mainly of

* Diagnosed in Abstract of Meeting of Nov. 30. Published Dec. 1, 1897.

forms obtained by Dr. Buller in Jalisco and worked out by Dr. Allen.

The Lower-Californian collection proves to be of unexpected interest, and contains the *Dasypterus ega xanthinus* and *Oryzomys peninsulæ* described in the last number of the 'Annals,' the badger (*Taxidea taxus infusca* *) brought by myself and the peninsular mule-deer (*Mazama hemionus peninsulæ* *) by Mr. Lydekker before the Zoological Society, and, finally, the species and subspecies described in the present communication.

There is also a *Natalus*, apparently inseparable from *N. stramineus*, the first record of this tropical genus in Lower California. The other bats appear to be ordinary Californian species.

Felis yaguarondi tolteca, subsp. n.

Colour, instead of the blackish grey varied by erythrism towards red of the typical form, pale grizzled fawn throughout, greyer on the head, fore neck, and limbs, clearer fawn posteriorly and on the tail, which above is grizzled fawn, and below unmixed fawn or rufous fawn. Under surface soiled whitish fawn, the underfur brownish grey, the longer hairs tipped with dull whitish.

Skull, while of equal breadth, much shorter and more stoutly built than in *typica*; crown higher and more convex, zygomata more massive, posterior narial fossa decidedly broader, bullæ lower. Ramus of lower jaw shorter and stouter.

Dimensions of the type (an old male, measured in the flesh):—

Head and body 570 millim.; tail 460; hind foot 138; ear 37.

Skull: basal length 84, basilar length of Hensel 82; greatest breadth 64; least interorbital breadth 18; intertemporal breadth 33·5; breadth of brain-case above auditory meatus 43; palate, length from henselion to posterior edge, excluding median notch, 36; breadth between outer corners of carnassials 38·7; breadth of posterior narial fossa 14; front of canine to back of carnassial 28·7; length of upper carnassial 11·3, of lower carnassial 9.

Hab. Tatemales, Sinaloa. Coll. P. O. Simons.

Type collected 16th June, 1897. Original number 513.

The above comparisons have been made with specimens

* Diagnosed in Abstract of Meeting of Nov. 30. Published Dec. 1, 1897.

from Southern Brazil, near the typical locality, Paraguay. But Veraguan and Guatemalan skins, like the S.-American ones, are blackish or rufous, without any of the peculiar fawny tone of *F. y. tolteca*.

This cat is perhaps that referred to by Baird* and Allen† as *F. yaguarondi*. The former of these authors had for examination only a skull, the latter two hunter's skins, without particulars, but probably from Jalisco.

Elliot‡ places in his synonymy of *F. yaguarondi* "*F. calomitti*, Baird, Mamm. N. Amer. t. 74. fig. 2 (skull)"; but this name is not on the plate, and the nearest I can find to it is Baird's "*Felis cacomitl*, Berl. MSS.," in the synonymy of *F. yaguarondi*, a reference which will certainly not give a status to the name, although, as already said, the skull figured is probably that of this form of the jaguarondi.

Felis mexicana, Desm., does not appear to belong to the present animal, as it is too large; but the name is in any case antedated by Turton's *F. mexicana*, which is one of the spotted tiger-cats.

Lynx rufus peninsularis, subsp. n.

Distinguished from other N.-American lynxes by its very small size (see cranial measurements below).

General colour of back pale rufous, tipped with grey, a few of the median dorsal hairs black-tipped, but there is no trace of longitudinal dark lines or markings, so that the colouring does not agree with that of Mearns's *L. rufus californicus*. Belly white, with black spots. Markings on face and ears apparently very much as in specimens from California proper, the black spot on the upper lip almost obsolete; the whitish patch on the back of the ear not extending to the anterior border.

Skull conspicuously different from that of any of the Mexican or Californian lynxes by its much smaller size, lesser development of the frontal convexity, and smaller, narrower brain-case.

Dimensions of the type (an adult male, measured in flesh):—

Head and body 607 millim.; tail 154; hind foot (*more Americano*) 160; ear 81.

Skull: basal length (basion to gnathion) 91·6; greatest breadth 76·5; nasals, length in middle line 23·5; interorbital

* Mamm. N. A. p. 88, and Rept. U.S. Boundary Comm. p. 12, pl. lxxiv. fig. 1 (skull) (1859).

† Bull. Am. Mus. N. H. iii. p. 176 (1890).

‡ Mon. Felidæ, text to pl. xiii.

breadth 21·5; breadth across postorbital processes 50; intertemporal breadth 38; breadth of brain-case on squamosals 51; greatest mastoid breadth 50; palate, length from gnathion 43, breadth between outer corners of carnassials 45; length of upper carnassial 13·4, of lower carnassial 11.

Hab. Santa Anita, Lower California. Coll. F. Pazik.

Type obtained June 21, 1896. Original number 432. Two specimens examined.

This animal is no doubt a pauperized peninsular race of the Californian lynx, from which it may be readily distinguished by its much smaller skull.

In the descriptions of Mearns's *Lynx rufus eremicus* and *L. r. californicus* no cranial measurements are given, but such external measurements as are supplied seem to indicate that these animals are about as large as the Californian and Mexican examples in the Museum collection, and no mention is made of their size being in any way inferior to that of the ordinary *L. rufus*.

Vespertilio fuscus peninsulæ, subsp. n.

Size small, about as in *propinquus* and *bahamensis*, decidedly smaller than in *typicus*. Dorsal fur 8-9 millim. in length. Colours pale, more as in the northern forms; general colour of back fawny brown, more fawn on head and fore back, browner (but still very pale) posteriorly; the basal halves of the hairs slaty black, the tips fawn.

Skull apparently very similar to that of *V. f. bahamensis*, both in size and shape, therefore far smaller than in *fuscus* and *miradorensis* (see measurements).

Dimensions of the type (an adult male, measured in flesh by collector):—

Forearm 43 millim. (range 40-44).

Head and body 61; tail 34; ear 14.

Skull: basal length 14·2; occipito-gnathic length* 16·5; greatest breadth 11·7; interorbital breadth 6·3; intertemporal breadth 3·8; front of canine to back of *m.*³ 6·2, the same below 6·7.

Hab. Sierra Laguna, Lower California. Coll. D. Coolidge.

Type collected July 7, 1896. Original number 385. Four specimens examined.

This little race of the United States "brown bat" is readily recognizable by its small size and pale colour. It will

* Mr. Miller, in his recent monograph, speaks of "occipito-nasal" length without explaining how it is taken. It is apparently to the front of the premaxillæ or "gnathion," and is so taken here.

be a matter of much interest to see whether it merges insensibly into the Californian bat, or is replaced abruptly by the latter in the northern parts of the peninsula. In the former case it would probably have to be considered as an independent southern modification of subsp. *typicus*, and in the latter, like *Dasypterus ega xanthinus* and *Natalus stramineus*, as a direct invader of the tropical part of the peninsula by one of the Central-American forms.

Peromyscus eva, sp. n.

A small rufous species with a long tail, in general appearance almost more like a *Reithrodontomys* or a small *Oryzomys* than a *Peromyscus*.

Size rather small. Fur close and straight. General colour sandy rufous, the head and fore back more greyish, the rump more rufous. Back lined with brown, but not conspicuously so; sides gradually becoming clearer rufous, which attains its brightest at its junction with the white of the belly. Under surface white, the slaty bases of the hairs showing through. Face greyish, with but slight tinge of rufous; a narrow dark line round the eye. Ears very large, very thinly haired, pale brownish, not conspicuously darker in colour than the head. Upper surface of hands and feet silvery whitish, not snowy white, the ankles rather duskier. Tail very long, much longer than head and body, very thinly haired, not pencilled, dull brown above, little or not lighter below, never conspicuously bicolor.

Skull with a broad low brain-case; supraorbital edges square, but not beaded. Palatal foramina reaching just to the level of the front edge of *m*.¹.

Dimensions of the type (an adult male, measured in the flesh):—

Head and body 88 millim.; tail 108*; hind foot 21; ear 17.

Skull: basal length 20·3; basilar length 18·8; greatest breadth 12·8; nasals, length 9·6; interorbital breadth 4; interparietal 3·7 × 9; breadth of brain-case on squamosals 11·7; palate length from henselion 10; diastema 6·6; palatal foramina 4·8 × 2·1; upper molar series 3·6.

Hab. San José del Cabo, Lower California. Coll. D. Coolidge.

Type collected July 29, 1896. Original number 525. Thirty-nine specimens examined, of which twenty-three are from Santa Anita, five from Sierra Laguna, and eleven from San José del Cabo.

* Range up to 128.

This pretty little mouse is quite different from any North-American species known to me. Its relationship appears on the whole to be with the *P. aztecus* group, of which it may be a diminutive peninsular representative*. Its small size, rufous colour, and long, thinly haired, and almost unicolor tail separate it widely from any Californian species hitherto described.

Peromyscus leucopus Coolidgei, subsp. n.

One of the pallid forms of this species. General colour above *exactly* matching that of specimens from Loveland, Colorado, assigned by Mr. G. S. Miller, their donor, to *P. l. nebrascensis*, Mearns; therefore by no means corresponding to the description of *P. l. Thurberi*, Allen †, from the San Pedro Martir Range, which is said to be "strongly varied with black, the prevailing tint being often decidedly blackish." Anterior part of outer surface of ear scarcely darker than back. Under surface sharply defined white, the slaty bases of the hairs showing through. Posterior part of sole and tail rather thinly haired for this group, the latter scarcely pencilled, its dorsal surface brown, the scales showing through; very different to the heavily haired and pencilled tail with black dorsal surface of *nebrascensis*.

Dimensions of the type (an adult female, measured in the flesh):—

Head and body 91 millim.; tail 76; hind foot, with claws, 22; ear 20.

Skull (imperfect behind): basilar length (c.) 19·5 ‡; greatest breadth 13; length of nasals 9·5; diastema 6·6; length of upper molar series 3·7.

Hab. Santa Anita, Cape Region of Lower California. Coll. D. Coolidge.

Type collected May 21, 1896. Original number 54. Four specimens examined.

Lepus californicus Xanti, subsp. n.

Similar to the typical form in most respects, but distinguished by its greyer ears and smaller size. General colour almost exactly as in pale examples of *typicus*, except that the cinnamon tinging of the belly is stronger. Ears greyer, with less suffusion of buffy or yellowish, the hairs on the inner

* Specimens of it were referred by Dr. Coues to *P. aztecus* in his monograph (Mon. N. Am. Rod. pp. 101, 102), but at that date no Mexican specimens were available for comparison.

† Bull. Am. Mus. N. H. v. p. 185 (1893).

‡ In a perfect specimen this dimension is 19·6.

surface white, and those on the anterior fringe white with some black ones intermixed; in *typicus* both are more or less yellow. Nape dark smoky grey, sometimes, as in the La Paz specimen, black.

Skull conspicuously smaller than in *typicus*, but otherwise generally similar. Supraorbital ledges weaker, the postorbital processes not or barely touching the skull posteriorly, not anchylosed with it.

Dimensions of the type (an adult female measured in flesh):—

Head and body 477 millim.; tail 63; hind foot, with claws, 120; ear from notch 125.

Skull: greatest length 88; basilar length 69; greatest breadth 41; nasals, diagonal length 38, greatest breadth 17.6; interorbital breadth, with ledges 22.6, without ledges 16.7; intertemporal breadth 13.3; diastema 24.5; palatal foramina 22.5×9.2 . Breadth of palatal bridge 6. Molar series (sockets) 14.7.

Hab. Santa Anita, Lower California. Coll. D. Coolidge.

Type obtained June 3, 1896. Original number 168.

This hare is, of course, that obtained by John Xantus at Cape St. Lucas in 1859 and 1860, and mentioned by Dr. Allen in his famous monograph of the Leporidæ*. I have therefore associated with it the name of its original finder, whose important collections were the first ever made in Lower California, but who has lost the credit for many of his discoveries owing to the "lumping" tendencies of the time at which the specimens arrived in Washington.

The small size of this hare, noticed by Dr. Allen, and its much greyer ears are amply sufficient for distinguishing it subspecifically from the true *Lepus californicus*. Gray's *Lepus Bennettii*, from San Diego, Cal., is smaller than the type of *L. californicus*, but is nevertheless much nearer to the latter than to the present form.

Bryant's *Lepus insularis*†, from Espiritu Santo Island, is possibly a black insular offshoot of the present hare, but seems locally constant enough to indicate subspecific distinction between the two.

With *Lepus martirensis*, Stowell‡, the Cape region hare seems to have no special relation.

Besides six specimens from Santa Anita and S. José del Cabo, obtained by Mr. Coolidge, the Museum contains an example of this same hare collected by Mr. A. Forrer at La Paz in 1880.

* Mon. N. Am. Rod. p. 358 (1877).

† P. Cal. Acad. iii. p. 92 (1891). (Syn. *L. Edwardsi*, St. Loup, 1895.)

‡ P. Cal. Acad. v. p. 51 (1895).

VIII.—*The Butterflies of the Transvaal.*

By W. L. DISTANT.

THAT troublesome region now known as the Transvaal Republic affords little satisfaction to the zoologist who attempts to isolate and describe its fauna. It has no distinctive faunistic element, and in zoogeography is merely part of the present somewhat ill-defined and less understood South-African division of the Ethiopian Region. In 1875 Dr. Sclater was inclined to define the South-African division as roughly embracing the "Cape Colony and adjoining districts," and as distinct from the South-western and South-eastern divisions. But geographical discovery and colonization have since then been the means of enlarging our collections and adding to our knowledge of the zoology of this now better known and less dark continent. In 1896 Mr. W. L. Sclater, in his series of articles on "The Geography of Mammals" *, defined the "Cape Subregion" as "including all Africa south of the watershed of the Congo on the West and of the Tana on the East Coast"—a homogeneous area even then none too large, and one which that high authority Dr. P. L. Sclater remarked to the writer might well include Somaliland. If this is true when mammals are studied, it is very evident when the butterflies of Africa are examined, and can be verified by consulting the series of papers which Dr. Butler has contributed to the Zoological Society during the last few years on the Lepidoptera of British East Africa and Somaliland.

The Transvaal has almost two butterfly faunas. The desolate plains or veld, typical of the best known and most frequented areas, can in no sense be described as an entomological paradise; but the northern and eastern frontiers, such as the Zoutspanberg and Barberton districts, possess Rhopalocera rich in number and subtropical in facies. A moderate belt of bush or forest extends along the East Coast from Delagoa Bay to and beyond Natal, and this warm forest-region is more or less represented in the East and North-east Transvaal.

The first real contribution to a knowledge of the butterflies of the Transvaal was given by the Swedish lepidopterist Pastor H. D. J. Wallengren, who worked out a collection made by N. Person †, and other species have been from time

* 'Geographical Journal,' vol. vii. p. 282.

† "Insecta Transvaaliensia," Öfversigt af k. Vetenskaps-Academiens Förhandlingar, 1875, p. 83. This collection, I learn from Dr. Auri-

to time identified and described by Mr. R. Trimen; the writer also published a list of his captures made during the years 1890-91. Since then three more years (1893-96) passed in the Transvaal have added largely to his previous collections, and the following specific enumeration, to which has been added the records of other workers, may be taken as a proximate account of our present knowledge of the butterflies of this area. From Dr. P. Rendall I received a list of his species taken near Eureka, sent to and identified by Mr. H. Grose-Smith, and from Dr. A. G. Butler a list of species taken by Mr. Kirby in the "Eastern Transvaal."

I am able to enumerate 238 species as found in the Transvaal, of which 162 are contained in my own collection and 76 are recorded elsewhere. The list will doubtless be increased when the warm and unhealthy north-eastern regions of the State have been visited by a good collector.

	Own collection.	Recorded elsewhere.	Total.
Danainæ	2	3	5
Satyrinæ	12	7	19
Acræinæ	17	4	21
Nymphalidæ	27	10	37
Lycænidæ	44	20	64
Pierinæ	29	12	41
Papilioninæ	6	4	10
Hesperiidæ	25	16	41
	<hr/> 162	<hr/> 76	<hr/> 238

Nymphalidæ.

DANAINÆ.

- Limnas chrysippus*, Linn. Generally distributed.
 Var. *alcippus*, Cram. Pretoria (March).
 Var. *dorippus*, Klug. Pretoria (March).
Amauris dominicanus, Trim. Barberton (January).

Recorded elsewhere.

- Amauris echeria*, Stoll. Barberton (Trimen, S. A. Butt.).
 — *albimaculata*, Butl. Eastern Transvaal (Butler, P. Z. S. 1898).
 — *ochlea*, Boisd. " " " "

Limnas dorippus, Klug, almost universally considered a varietal form of *L. chrysippus*, is a rare butterfly in South Africa. I took one specimen near Pretoria from among a very large

villius, is not located at Stockholm, but is contained in the Museum of Malmö, in the most southern part of Sweden.

concourse of the typical form in the month of March, and this capture surprised Mr. Trimen. In the same month of another year I also took a specimen in the bush on the back-beach at Durban, when Mr. A. D. Miller, a well-known lepidopterist of that port, told me that though he had collected for sixteen years, he had never seen a specimen.

Amauris is a very scarce genus in the Transvaal, and appears to be only recorded from the Eastern districts. At Barberton, in the thick bush high up Rymer's Creek, I took a pair of *A. dominicanus*, and Mr. Trimen received *A. echeria* from the same neighbourhood.

SATYRINÆ.

- Ypthima asterope*, Klug. Barberton (January), Zoutpansberg (May).
Cænura hebe, Trim. Barberton (January).
Phycæneura panda, Boisd. Pretoria (January).
Pseudonympha narycia, Wallengr. Pretoria (Nov., Dec., Jan.), Middelburg (Nov.).
 — *neita*, Wallengr. Barberton (*Dr. P. Rendall*).
 — *sabacus*, Trim. Zoutpansberg (*Kæssner*), Barberton (*Dr. P. Rendall*).
 — *vigilans*, Trim. Pretoria (Nov., Dec.), Johannesburg (*Cregoe*).
 — *cassius*, Godt. Barberton (*Harrison*).
Leptoneura dingana, Trim. Zoutpansberg (*Kæssner*), Barberton (*Dr. P. Rendall*).
Samanta perspicua, Trim. Zoutpansberg (May), Barberton (January).
Melanitis leda, Linn. Pretoria (Aug. and Sept.).
Meneris tulbaghia, Linn. Barberton (*Dr. P. Rendall*).

Recorded elsewhere.

- Pseudonympha natalii*, Boisd. Crocodile River (*Trimen*, S. A. Butt.).
Leptoneura Bouckeri, Trim. Lydenburg District " "
Mycalesis Simonsii, Butl. Limpopo River " "
Lethe indosa, Trim. Lydenburg District " "
Pseudonympha pætula, Trim. Lydenburg District (*Trimen*, Tr. Ent. Soc. 1891).
Melanitis diversa, Butl. Eureka District (*Dr. P. Rendall*, ident. by Mr. H. Grose-Smith).
Mycalesis safitza, Hew. Eastern Transvaal (*Butler*, P. Z. S. 1898).

Wallengren ("Insecta Transvaaliensia") enumerated *Pseudonympha hippia*, Cram., but Mr. Trimen has referred this identification to his *P. sabacus*.

The more or less bare open veld country is not the rendezvous for Satyrinæ. Of the twelve species I brought back with me it will be seen that only four were obtained in the Pretoria district. Of these I procured three on my first visit, and another three years' collecting only produced one other species. One of these—*Melanitis leda*—I also found very rare.

ACRÆINÆ.

- Acræa horta*, Linn. Pretoria (Aug., Nov., Dec., Feb.), Zoutpansberg (*Kæssner*).
 — *neobule*, Doubl. & Hew. Pretoria (April, Sept., Oct.), Pienaars River (March), Zoutpansberg (May).
 — *violarum*, Boisd. Zoutpansberg (May), Barberton (*Dr. P. Rendall*).
 — *nohara*, Boisd. Barberton (*Dr. P. Rendall*).
 — *Doubledayi*, Guér. Crocodile Poort (Jan.), Zoutpansberg (May).
 — *caldarena*, Hew. Zoutpansberg (May).
 — *natalica*, Boisd. Crocodile Poort (Jan.), Zoutpansberg (*Kæssner*).
 — *anemosa*, Hew. Pretoria (Jan., Sept.), Pienaars River (March), Middelburg (Jan.), Zoutpansberg (*Kæssner*).
 — *acara*, Hew. Pretoria (Jan.), Barberton (Jan.).
 — *encedon*, Linn. Zoutpansberg (May).
 — *rahira*, Boisd. Pretoria (Feb., March), Warm Baths, Waterberg (Dec.), Middelburg (Jan.), Zoutpansberg (*Kæssner*).
 — *anacreon*, Trim. Barberton (*Dr. P. Rendall*), Lydenburg District (*Zutrzenka*).
 — *Buxtoni*, Butl. Pretoria (March), Barberton (Jan.), Zoutpansberg (May).
 — *cabira*, Hopff. Barberton (Jan.).
Planema csebria, Hew. Barberton (Jan.).
 — *aganice*, Hew. Barberton (*Harrison*).
Pardopsis punctatissima, Boisd. Barberton (Jan.).

Recorded elsewhere.

- Acræa aglaonice*, Westw. Lydenburg, Marico, Upper Limpopo River (*Trimen*, S. A. Butt.).
 — *stenobea*, Wallengr. Potchefstroom, Upper Limpopo River (*Trimen*, S. A. Butt.).
 — *Barberi*, Trim. Pretoria District (*Trimen*, S. A. Butt.).
 — *acrita*, Hew. Eastern Transvaal (*Butler*, P. Z. S. 1898).

Wallengren ("Insecta Transvaaliensia") also enumerates *A. hypatia*, Dru., and *A. lycia*, Fabr., but the first probably = *A. natalica*, Boisd., and the second is treated by Trimén as a variety of *A. encedon*, Linn.

Both the typical (rufous) form of *A. encedon*, Linn., and the pale form of the species (*A. lycia*, Fabr.) I took in Zoutpansberg in May and at Delagoa Bay in September.

NYMPHALINÆ.

- Atella columbina*, Cram. Pretoria (Feb., March), Zoutpansberg (*Kæssner*).
Pyrameis cardui, Linn. Pretoria (throughout the year).
Eurema schoneia, Trim. Barberton (Jan.).
Junonia cebrene, Trim. Pretoria (May, Aug., Dec., generally throughout the year), Johannesburg (*Cregoe*), Barberton (Jan.).
 — *clelia*, Cram. Pienaars River (March), Zoutpansberg (May).
 — *boöpis*, Trim. Pretoria (Jan., Feb., May), Barberton (*J. R. Harrison*).

- Precis cloantha*, Cram. Pretoria (Jan., March, Sept., Dec.), Johannesburg (*Cregoe*), Zoutpansberg (*Kæssner*).
 — *ceryne*, Boisd. Middelburg (Jan.), Barberton (*Dr. P. Rendall*), Zoutpansberg (*Kæssner*).
 — *tukwa*, Wallengr. Pretoria (April), Zoutpansberg (May), Barberton (*J. R. Harrison*).
 — *octavia*, Cram., var. Pretoria, Johannesburg (*Cregoe*).
 — *sesamus*, Trim. Pretoria (Feb., April, May), Johannesburg (*Cregoe*).
 — *archesia*, Cram. Pretoria (Feb., March).
 — *pelusgis*, Godt. Pretoria (Jan., Feb.), Barberton (*Dr. P. Rendall*), Zoutpansberg (*Kæssner*).
Protogoniomorpha anacardii, Linn. Barberton (*Dr. P. Rendall*).
Eurytela hiarbas, Dru. Barberton (Jan.).
 — *dryope*, Cram. Barberton (*J. R. Harrison*).
Hypanis ilithyia, Dru. Pretoria (Jan., Feb.), Pienaars River (March), Zoutpansberg (May).
Neptis agatha, Cram. Zoutpansberg (May), Barberton (*Dr. P. Rendall and J. R. Harrison*).
Hypolimnas misippus, Linn. Pretoria (Jan., Feb., April).
 Var. *inaria*, Cram. Pretoria (Jan., Feb., March, April).
Hamanumida dædalus, Fabr. Pretoria (Aug. to June), Zoutpansberg (May), Barberton (*J. R. Harrison*).
Harma alcimeda, Godt. Barberton (*J. R. Harrison*).
Charaxes varanes, Cram. Barberton (*J. R. Harrison*).
 — *Druceanus*, Butl.
 — *saturnus*, Butl. Pretoria "Dec., Feb.", Rustenburg (Dec.).
 — *brutus*, Cram. Barberton (*J. R. Harrison*).
 — *ethalion*, Boisd. " "
 — *xiphares*, Cram. " "

Recorded elsewhere.

- Atella phalantha*, Dru. Potchefstroom, Marico River (*Trimen*, S. A. Butt.).
Precis tugela, Trim. Lydenburg District (*Trimen*, S. A. Butt.).
Crenis natalensis, Boisd. " "
Charaxes candiope, Godt. Limpopo River "
 — *castor*, Cram. Barberton "
 — *phæus*, Hewits. " "
 — *jukhusa*, Trim. (*Wallengren*, Insect. Transvaaliensia.)
Precis elgiva. Eureka District (*Dr. P. Rendall*, ident. by Mr. H. Grose-Smith).
Charaxes achæmenes, Feld. Eureka District (*Dr. P. Rendall*, ident. by Mr. H. Grose-Smith).
Crenis Boisduvali, Wallengr. Eastern Transvaal (*Butler*, P. Z. S. 1898).

I found *Precis octavia* var. exceedingly scarce in the Transvaal, having only secured one specimen at Pretoria. I have since received another example from Johannesburg. *P. sesamus*, on the contrary, was very abundant, and always during the wet or summer season, frequenting my small flower-garden. Hence I have found no evidence for the proposition made by Mr. Guy A. K. Marshall (Trans. Ent. Soc. 1896, p. 557) that the two species are identical, or, rather, that *P. octavia* is the wet-season and *P. sesamus* the dry-season form.

Mr. Trimen has recorded that he "once noticed a *chrysippus* for a long time pursue a ♀ *misippus*," and that he had little doubt "that the former mistook the latter for a female of its own species." I have frequently witnessed the operation reversed. During the month of April 1895 these species were particularly abundant in my garden, but the ♀ *H. misippus* were very scarce, and I frequently watched the males of that species chasing the female Danaids till they found their mistake. When the *Hypolimnas* ♂ found his true ♀, the two sexes generally soared high and disappeared.

Lycænidae.

- Zeritis aranda*, Wallengr. Pretoria (Sept.), Johannesburg (*Cregoe*).
 — *almeida*, Feld. Barberton (*Dr. P. Rendall*).
 — *molomo*, Trim. Johannesburg (*Cregoe*).
 — *thyræ*, Linn. Pretoria (Nov., Jan.).
 — *orthrus*, Trim. Pretoria (Sept., Jan.), Johannesburg (*Cregoe*), Barberton (*Dr. P. Rendall*), Zoutpansberg (*Kæssner*).
Chrysophanus orus, Cram. Pretoria (Oct.).
Arrugia basuta, Wallengr. Middelburg (Nov.).
Crudaria leroma, Wallengr. Pretoria (Oct.).
Catochrysops patricia, Trim. Pretoria (Oct., Nov.).
 — *glauca*, Trim. Pretoria (Oct., Dec.).
 — *osiris*, Hopff. Warm Baths, Waterberg (Dec.), Zoutpansberg (May), Barberton (May).
 — *parsimon*, Fabr. Pretoria (Dec.).
 — *asopus*, Hopff. Pretoria (Dec.).
 — *cissus*, Godt. Johannesburg (*Cregoe*), Barberton (*Dr. P. Rendall*), Zoutpansberg (*Kæssner*).
Polyommatus bæticus, Linn. Pretoria (Nov., Dec.), Johannesburg (*Cregoe*), Barberton (*Harrison*).
Zizera lysimon, Hübn. Pretoria (Oct., April).
 — *gaika*, Trim. Pretoria (Dec.), Barberton (*Dr. P. Rendall*).
 — *lucida*, Trim. Barberton (*Dr. P. Rendall*).
Everes mahallokoæna, Wallengr. Pretoria (Jan., Feb., Dec.), Warm Baths, Waterberg (Dec.), Barberton (*Harrison*).
Nacaduba sichela, Wallengr. Barberton (*Dr. P. Rendall*).
 — *dolorosa*, Trim. Barberton (*Dr. P. Rendall*).
Azamas jesus, Guér. Pretoria (Jan., April, Oct., Dec.).
 — *moriqua*, Wallengr. Pretoria, Barberton (Jan.).
 — (?) *macalenga*, Trim. Warm Baths, Waterberg (Dec.), Zoutpansberg (May).
Tarucus sybaris, Hopff. Pretoria (Oct., Nov.).
 — *telicanus*, Lang. Pretoria (Oct., Dec., March), Barberton (Jan.), Zoutpansberg (May).
Castalius melæna, Trim. Pretoria (Jan.), Zoutpansberg (May).
 — *calice*, Hopff. Barberton (*Harrison*).
 — *hintza*, Trim. Pretoria (Jan.).
Hyreus lingueus, Cram. Pretoria (Jan.), Barberton (Jan.).
 — *palemon*, Cram. Pretoria (Oct., May, Dec.), Barberton (*Dr. P. Rendall*).
Lycænesthes liodes, Hew. Pretoria (Feb.).
 — *amarah*, Guér. Pretoria (Jan., March, Dec.), Barberton (*Dr. P. Rendall*).

- Uranothauma nubifer*, Trim. Pretoria (Jan.).
Hypolycaena lara, Linn. Pretoria (March, May, Oct.), Johannesburg (Cregoe), Zoutpansberg (Kæssner).
Chrysorychia harpar, Fabr. Pretoria (Jan., Aug., Nov., Dec.), Zoutpansberg (Kæssner).
 — *amanga*, Westw. Pretoria (Jan., March).
Deudorix licinia, Mab. Pretoria (April, May).
Spindasis natalensis, D. & H. Pretoria (Dec., Jan.).
 — *masilikazi*, Wallengr. Pretoria (Jan., Aug., Dec.).
Tatura philippus, Fabr. Pretoria (April).
Iolaus Trimeni, Wallengr. Pretoria (Dec.).
Stugeta Bowkeri, Trim. Pretoria (Jan., Feb.), Warm Baths, Waterberg (Dec.).
Myrina ficedula. Pretoria (Dec., Jan.), Zoutpansberg (Kæssner).

Recorded elsewhere.

- Lycæna hypopolia*, Trim. Potchefstroom (Trimen, S. A. Butt.).
 — *jobates*, Hopff. " "
 — *niobe*, Trim. " "
 — *ignota*, Trim. " "
 — *trochilus*, Freyer. " "
 — *notobia*, Trim. " "
Deudorix antalus, Hopff. Potchefstroom, Limpopo River (Trimen, S. A. Butt.).
 — *dinomenes*, H. Grose-Smith. Marico River (Trimen, S. A. Butt.).
Capys alphæus, Cram. Potchefstroom, Lydenburg District (Trimen, S. A. Butt.).
Iolaus mimosæ, Trim. Limpopo River (Trimen, S. A. Butt.).
Aphnæus ella, Hewits. Potchefstroom, Marico and Limpopo Rivers (Trimen, S. A. Butt.).
 — *phanes*, Trim. Eureka (Trimen, S. A. Butt.).
 — *Hutchinsonii*, Trim. Eureka (Trimen, S. A. Butt.).
Zeritis æthon. Lydenburg District "
 — *malagrida*, Wallengr. No precise locality (Trimen, S. A. Butt.).
 — *taikosama*, Wallengr. " "
D'Urbania amakosa, Trim. Lydenburg District "
Arrugia protumnus. Kalkfontein (Trimen, S. A. Butt.).
Capys disjunctus, Trim. Barberton (Trimen, Tr. Ent. Soc. 1895).
Cupido asteris, Godt. (Wallengren, Insecta Transvaaliensia.)

Papilionidæ.

PIERINÆ.

- Mylothris agathina*, Cram. Pretoria (Feb., May), Zoutpansberg (May).
 — *Rippelli*, Koch. Zoutpansberg (Kæssner).
Colias electra, Linn. Pretoria (throughout the year), Barberton (Dr. P. Rendall), Zoutpansberg (Kæssner).
Terias brigitta, Cram. Pretoria (Aug., Sept., Oct.), Zoutpansberg (May).
 — *zoe*, Hopff. Pretoria (Jan., Feb., March, Oct.), Pienaars River (March), Zoutpansberg (May), Rustenburg (Dec.).
 — *regularis*, Butl. Barberton (Jan.).
Teracolus subfasciatus, Swains. Pienaars River (March), Zoutpansberg (May).
 — *eris*, Klug. Pretoria (Feb.), Pienaars River (March).

- Teracolus agoye*, Wallengr. Pienaars River (March).
 — *ione*, Godt. (?). Lydenburg District (*Zutrzenka*).
 — *regina*, Trim. " "
 — *anna*, Wallengr. " "
 — *auco*, Leech. Pienaars River "
 — *evenina*, Wallengr. Pretoria (Feb., Dec.), Pienaars River (March).
 — *achine*, Cram. Pienaars River (March), Crocodile Poort (Jan.), Zoutpansberg (May).
 — *garisa*, Wallengr. Barberton (Jan.), Zoutpansberg (May).
 — *omphale*, Godt. Zoutpansberg (May).
 — *theogone*, Boisd. Pretoria, Zoutpansberg (May).
 — *phlegetonia*, Boisd. Pretoria (Oct.), Pienaars River (March), Zoutpansberg (May).
 — *celimene*, Luc. Pretoria (Nov.).
 — *vesta*, Reiche. Zoutpansberg (May).
Catopsilia florella, Fabr. Pretoria (March, May), Johannesburg (*Cregoe*), Crocodile Poort (Jan.), Zoutpansberg (May), Barberton (*Harrison*).
Belenois zochalia, Boisd. Pretoria (Jan.), Johannesburg (*Cregoe*).
 — *mesentina*, Cram. Pretoria (Feb.), Johannesburg (*Cregoe*), Pienaars River (March), Zoutpansberg (May).
 — *severina*, Cram. Pretoria (Dec.), Johannesburg (*Cregoe*), Barberton (*Harrison*), Zoutpansberg (May).
Synchlœ hellica, Linn. Pretoria (Aug., Sept., Dec.), Johannesburg (*Cregoe*), Pienaars River (Oct.), Zoutpansberg (May).
Pinacopteryx charina, Boisd. Barberton (*Harrison*).
Herpenia eriphia, Godt. Pretoria (Feb.), Pienaars River (March).
Eronia teda, D. & H. Lydenburg District (*Zutrzenka*).

Recorded elsewhere.

- Terias Desjardinsii*, Boisd. Lydenburg District (*Trimen*, S. A. Butt.).
Pieris pigea, Boisd. Potchefstroom (*Trimen*, S. A. Butt.).
Teracolus phlegyas, Butl. Marico and Limpopo Rivers, Lydenburg District (*Trimen*, S. A. Butt.).
 — *topha*, Wallengr. Lydenburg District (*Trimen*, S. A. Butt.).
 — *antevippe*, Boisd. "
 — *antigone*, Boisd. Lydenburg District, Limpopo River (*Trimen*, S. A. Butt.).
Eronia Buquetii, Boisd. No exact locality (*Trimen*, S. A. Butt.).
Terias floricola, Boisd. Eureka District (*Dr. P. Rendall*, ident. by Mr. H. Grose-Smith).
 — *æthiopica*, Trim. Eureka District (*Dr. P. Rendall*, ident. by Mr. H. Grose-Smith).
 — *Butleri*, Trim. Eureka District (*Dr. P. Rendall*, ident. by Mr. H. Grose-Smith).
Pieris saba, Fabr. Eureka District (*Dr. P. Rendall*, ident. by Mr. H. Grose-Smith).
 — *gidica*, Godt. Eureka District (*Dr. P. Rendall*, ident. by Mr. H. Grose-Smith).

The genus *Teracolus*, though the subject of much revision, is still in an unsatisfactory condition. The species which I have followed Mr. Trimén in considering identical with the Abyssinian *T. vesta*, Reiche, is pronounced by Dr. Butler to

be distinct and to represent his *T. mutans* (Ann. & Mag. Nat. Hist. ser. 6, vol. xx. p. 505). In the same way the *T. ione*, Godt., as interpreted by Trimen, is probably *T. imperator*, Butl. However, we must await Miss Sharpe's monograph on the genus, when we may expect to find these species, forms, races, and varieties figured.

PAPILIONINÆ.

Papilio corinneus, Bertol. Zoutpansberg (*Kæssner*).

— *demoleus*, Linn. Pretoria (Sept.).

— *ophidicephalus*, Oberth. Barberton (Jan.).

— *constantinus*, Barberton (*Harrison*).

— *lyæus*, D. & H. Barberton (Jan.); also seen flying at Rustenburg in December.

— *echerioides*, Trim. Barberton (*Dr. P. Rendall*), Zoutpansberg (*Kæssner*).

Recorded elsewhere.

Papilio euphranor, Trim. Lydenburg District (*Trimen*, S. A. Butt.).

— *leonidas*, Fabr. Eureka District (*Dr. P. Rendall*, ident. by Mr. H. Grose-Smith).

— *cenea*, Stoll, form *tibullus*, Kirby. Eureka District (*Dr. P. Rendall*, ident. by Mr. H. Grose-Smith).

— *erinus*, Gray. Eastern Transvaal (Butler, P. Z. S. 1898).

Hesperiidæ.

Cyclopides metis, Linn. Barberton (*Harrison*).

— *tsita*, Trim. Pretoria (Dec., Jan.), Rustenburg (Dec.).

— *Willemi*, Wallengr. Pretoria (Feb.).

Hesperia vindex, Cram. Pretoria (Nov.).

— *dromus*, Plotz. Pretoria (Feb., March), Barberton (Jan.).

— *mafa*, Trim. Pretoria (Sept., Oct.), Pienaars River (March).

— *asteroidia*, Trim. Pretoria (Sept.).

— *diomus*, Hopff. Pretoria (Jan., Feb., Aug.), Zoutpansberg (*Kæssner*).

— *sataspes*, Trim. Pretoria (Sept.).

Carcharodus elma, Trim. Barberton (Jan.).

Kedestes callicles, Hew. Pretoria (Feb.).

— *tucusa*, Trim. Rustenburg (Dec.).

Padraona zeno, Trim. Barberton (Jan.).

Gegenes hottentota, Latr. Pretoria (Feb., March, April, May), Barberton (Jan.), Waterberg (*Wilde*), Zoutpansberg (May).

Platylesches amadhu, Mab. Pretoria (Jan., April, Nov.), Pienaars River (March), Barberton (*Dr. P. Rendall*).

Chapra mohopaani, Wallengr. Pretoria (April).

Abantis tettensis, Hopff. Warm Baths, Waterberg (Dec.).

Leucochitonea levubu, Wallengr. Waterberg (*Wilde*), Zoutpansberg (*Kæssner*).

Sarangesa djælele, Wallengr. Pretoria (Jan., Feb., Dec.), Barberton (Jan.), Zoutpansberg (*Kæssner*).

Sape motozi, Wallengr. Pretoria, Barberton (*Harrison*), Zoutpansberg (*Kæssner*).

— *kobela*, Trim. Barberton (Jan.).

Celaenorrhinus mokeezii, Wallengr. Barberton (*Harrison*), Zoutpansberg (*Kaessner*).

Tagiades fesus, Fabr. Barberton (*Harrison*).

Rhopalocampta forestan, Cram. Pretoria (April).

— *pisistratus*, Fabr. Pretoria (Jan, Feb., April, Nov., Dec.).

Recorded elsewhere.

Cyclopides malgacha, Boisd. Potchefstroom (*Trimen*, S. A. Butt.).

— *ægipan*, Trim. Lydenburg District "

— *meninx*, Trim. Potchefstroom "

Pyrgus transvaalæ, Trim. Potchefstroom "

— *mohozutza*, Wallengr. Lydenburg District "

Thymelicus lepenula, Wallengr. Potchefstroom "

— *barberæ*, Trim. No special locality "

Pamphila Morantii, Trim. Upper Limpopo "

— *moritili*, Wallengr. Lydenburg District "

— *Ayresii*, Trim. "

Abantis venosa, Trim. Barberton "

Caprona canopus, Trim. Potchefstroom "

Pamphila borbonica, Boisd. (*Wallengren*, Insecta Transvaaliensia.)

Stercopes monochromus, Mab. (Soc. Ent. de Belg. 1891, p. lxiv.)

Pamphila icteria, Mab. (Soc. Ent. de Belg. 1891, p. clxxx.)

Sape pertusa, Mab. (Soc. Ent. de Belg. 1891, p. lxxviii.)

IX.—A Revision of the Pierine Butterflies of the Genus *Terias* from the Old World. By ARTHUR G. BUTLER, Ph.D., F.L.S., F.Z.S., &c., Senior Assistant-Keeper, Zoological Department, British Museum.

THE genus *Terias* has always been a puzzle to Lepidopterists and probably will never be thoroughly understood until the whole of the species have been reared from the egg throughout the year and in all parts of the world where they exist. At the same time, the careful labelling and dating of collections in recent years and the study which has been devoted to this genus in India and Africa have thrown considerable light upon the relationship of the numerous forms which, even in my "Notes on the Genus *Terias*" (*Ann. & Mag. Nat. Hist.* ser. 5, vol. xvii. pp. 212-225), I was obliged to regard, for want of evidence to the contrary, as distinct species.

The researches of Capt. E. Y. Watson, C. W. Barker, and G. A. K. Marshall have conclusively proved that many of the supposed species of the genus are either seasonal or varietal: the wet-season forms having the under surface of the wings white or yellow, usually with somewhat feeble markings, or even none at all; the dry-season forms either reddish in colour, sometimes with ill-defined markings, or

with the ground-colour of the wet-season and sharply-defined markings, the primaries also with an oblique row of dots, a zigzag bar, or a large patch of chocolate at or near the apex—this form is also often characterized by dense dusky irroration of the under surface. In the transition from the rainy to the dry-season an intermediate form occurs. Variation, in the sense of simple inconstancy of pattern, chiefly affects the width of the borders on the upper surface, and, curiously enough, this inconstancy in some species is dependent upon season, whilst in others it occurs at all seasons. It is this puzzling inconsistency in the variation of the species which has been responsible for many of the synonyms in this genus, as well as for much confusion in the writings of the best intentioned workers respecting the geographical distribution of some of the commoner species.

The Museum series of Old-World *Terias* has, for many years, been the finest in existence; and the recent donation of the Godman and Salvin collection of these butterflies has rendered it so complete that, in combining and rearranging the two series in our cabinets, many new facts have come to light and a tentative revision of the synonymy has become practicable, but only breeding in every locality can finally decide whether or not this reduction of the species of the past goes too far or not far enough: in any case I offer it to Lepidopterists as what I conscientiously believe to be a step in the right direction.

The Museum collection of typical *Terias* at present occupies thirty cabinet drawers, nearly the whole of the forms described from the Old World being represented, and most of them in all their seasonal forms. It must, however, be noted that, as in *Teracolus*, those countries which have practically no wet season nevertheless produce the three phases of a species as coexistent varieties. It would therefore seem that existing variations have been adapted to the seasons, and not produced by them, as has been assumed.

SECTION I.

The most simple section of the genus is characterized by the absence of glandular or scale patches on the front wings of the males, and includes the *T. brigitta*, *nise*, *albula*, *agave*, *messalina*, *deva*, *harina*, *candida*, and *Desjardinsii* groups of the genus: some of these which are only found in the New World I shall not discuss in the present paper.

T. brigitta group.

Characterized by a tolerably regular blackish border to

the costa and outer margin of the primaries above, this border not reaching the external angle in the females; the under surface of the dry-season form often largely suffused with rose-reddish or flesh-colour.

1. *Terias pulchella*.

Xanthidia pulchella, Boisduval, Faun. Madag. p. 20, pl. ii. fig. 7 (1833).

Mauritius and Madagascar.

The dry-season form has the apex of the primaries and the secondaries suffused with rose-reddish on the under surface. The species is represented in the Museum by eighteen examples.

We have in the Museum a single male of a species from Fwambo, Tanganyika, which (excepting in its much more rounded wings) bears a curious resemblance to *T. pulchella*; it is, however, destitute of markings on the under surface. I thought at one time that it might possibly be a very aberrant example of *T. regularis*, but it looks so utterly out of place with that species that I feel convinced it will prove to be a new thing; nevertheless I hesitate to name it until we receive further evidence.

2. *Terias brigitta*.

Papilio brigitta, Cramer, Pap. Exot. iv. pl. cccxxxi. B, C (1782).

Terias zoe, Hopffer, Ber. Verh. Ak. Berl. 1855, p. 640; Peters's Reise, Zool. v. p. 369, pl. xxiii. figs. 10, 11 (1862).

Terias candace, Felder, Reise der Nov., Lep. ii. p. 213 (1865).

Terias caffra, Felder, l. c.

♀. *Terias seruli*, Westwood in Oates's Matabele-land, p. 342 (1881).

Ranges from the Cape of Good Hope northwards to Abyssinia and westwards from Angola to Sierra Leone.

The wet form is *T. zoe=caffra*, the intermediate form is *T. candace=seruli*, and the dry form is typical *T. brigitta*: males both of the intermediate and dry forms seem to be very rare; it therefore seems possible that the females may live until the commencement of the wet season, or possibly they may take little part in the reproduction of the species. Among our ninety-two examples of *T. brigitta* only two males belong to the intermediate, and one to the dry form.

3. *Terias libythea*.

Papilio libythea, Fabricius, Ent. Syst. Suppl. p. 427 (1798).

Terias drona, Horsfield, Cat. Lep. E. I. C. p. 137, pl. i. fig. 13 (1829).

Terias lerna, Felder, Sitz. Ak. Wiss., math.-nat. Cl. xl. p. 448 (1860).

Terias senna, Felder, Reise der Nov., Lep. ii. p. 212 (1865).

Terias rubella, Wallace, Trans. Ent. Soc. ser. 3, vol. iv. p. 323 (1867).

Terias hainana, Moore, P. Z. S. 1878, p. 700.

The range of this species appears to extend from the Himalayas eastwards to Southern China and Hainan, southwards to Ceylon, and thence south-eastwards to Timor; we also have one example from Amboina.

The wet form is represented by *T. senna*=*lerna*, the intermediate form by *T. drona*, and the dry form is typical *T. libythea*=*rubella*=*hainana*: the latter has the fringes rosy and the border of the secondaries reduced to triangular spots; in the intermediate form these spots are confluent in the male, forming a dentated border*.

4. *Terias zoraide*.

Terias zoraide, Felder, Reise der Nov., Lep. ii. p. 213 (1865).

Terias australis, Wallace, Trans. Ent. Soc. ser. 3, vol. iv. p. 321 (1867).

Terias sinta, Wallace, t. c. p. 322.

Terias immaculata, Miskin, P. R. Soc. Queensl. vi. p. 253 (1889).

Ranges from Bourou southwards to Australia.

T. australis=*zoraide* is the wet form; *T. sinta*=*immaculata* the dry.

T. euterpe and *T. neda* of the New World appear to be best placed in this group, in spite of the somewhat different character of their under-surface markings.

T. harina group.

The wet-season forms differ from the dry in the much greater width of the outer blackish border to the primaries; between the two seasons this border is intermediate in width.

5. *Terias harina*.

Terias harina, Horsfield, Cat. Lep. E. I. C. p. 137 (1829); Hübner, Zutr. exot. Schmett. figs. 979, 980 (1837).

Ranges from N.E. India through Burma, the Mergui Archipelago and Andamans, Malacca, Java, and Borneo, eastwards to the Celebes.

The name *T. formosa* was probably first given to Hübner's figures of *T. harina* by the late Adam White, and thus appeared in a list of the species of this genus which I published (P. Z. S. 1871, p. 540) at a time when I had no perfect copy of Hübner's work for reference. In that list, oddly enough, I transposed the sexes—the type of *T. harina* being a female, that of Hübner's illustrations a male.

In the Philippines a fairly distinct race occurs, of which

* *T. hainana* has a slightly narrower border to the primaries than *T. libythea*.

I have seen no extreme dry type: the wet form is larger than in *T. harina*, the blackish outer border extending to the secondaries even in the males, where it runs from the apex to beyond the third median branch, and in the females sometimes to beyond the first branch; the costal margin in this form is also much less arched than in *T. harina*: the intermediate form is normal.

6. *Terias butyrosa*.

Terias butyrosa, Butler, Ann. & Mag. Nat. Hist. ser. 4, vol. xv. p. 396 (1875).

Aru Islands.

I have only seen the dry-season form of this *Terias* and therefore have not sufficient evidence on which to conclude that it is a race of *T. harina*; it differs from the dry-season form of that species in the more uniform width and continuous character of the blackish border to the primaries.

T. candida group.

The species of this group do not appear to exhibit any appreciable seasonal characters; they also differ from the *T. harina* group in the fact that the females are not very variable in the same species: white is the characteristic colouring of the upper surface in all the species excepting those of the Solomon group, which have yellow females.

7. *Terias virgo*.

Terias virgo, Wallace, Trans. Ent. Soc. ser. 3, vol. iv. p. 328 (1867).

Aru Islands.

8. *Terias puella*.

Xanthidia puella, Boisduval, Voy. de l'Astr., Lép. p. 60, pl. ii. fig. 8 (1832).

Probably throughout the Halmaheira group; we have it from Waigiou, Batchian, Ternate, and Morty.

9. *Terias papuana*, sp. n.

Differs from the two preceding species in the more regular and slightly more concave inner edging of the black outer border to the wings, which runs farther back on the costa of the primaries; in the majority of the males this border is wider than in either *T. virgo* or *T. puella*, and in the females it is invariably wider than in *T. virgo*: the expanse of wings varies considerably, 39 to 54 millimetres.

From Mysol through New Guinea to Cape York.

10. *Terias xanthomelæna*.

Terias xanthomelæna, Godman & Salvin, P. Z. S. 1879, p. 159.

New Ireland and Duke of York Island.

This species may chiefly be distinguished from the following by the width and opacity of the basal and abdominal brown suffusion, and in the generally more concave inner edge to the outer border of the primaries and the narrower border of the secondaries.

11. *Terias candida*.

Papilio candida, Cramer, Pap. Exot. iv. pl. cccxxxi. A (1782).

Amboyna and Ceram.

12. *Terias Woodfordi*, sp. n.

♂. Gamboge-yellow with black-brown borders, with tolerably regularly concave inner margins, that of the primaries considerably wider on the costa than in any other species of the group, though at the external angle no wider than in *T. candida*.

♀. Similar to the male, but lemon-yellow, more or less irrorated at the base of the wings with dusky scales. Expanse of wings varying from 34 to 53 millim.

Guadalcanar, Maleita, and Florida Islands (*Woodford*).

The whole of our sixteen examples of this species were received from Messrs. Godman and Salvin.

13. *Terias salomonis*, sp. n.

Differs in both sexes from the preceding species in the narrower external borders of both sexes. Expanse of wings 45 to 54 millim.

Fauro and Alu Islands (*Woodford*).

The eight specimens of this species in the collection were received from Messrs. Godman and Salvin.

T. Desjardinsii group.

The wet- and dry-season forms differ considerably: in the latter the dark border to the secondaries is reduced to a series of dots terminating the nervures; on the under surface also the apex of the primaries is often suffused with rose-colour, and two or three deep brown markings appear somewhat as in the *T. hecabe* section of the genus.

14. *Terias regularis*.

Terias regularis, Butler, Ann. & Mag. Nat. Hist. ser. 4, vol. xviii. p. 486 (1876).

Terias Oberthürrii, Mabille, Bull. Soc. Zool. France, ii. p. 223 (1877).

From Abyssinia southwards to Nyasa, and on the west coast from the Congo northwards to the Niger.

This species has been confounded with the S.-African representative of *T. Desjardinsii* by Mr. Marshall; it is, however, widely distinct, the female especially differing in the typical (wet-season) form in its broad hind-wing border; both sexes also differ in their less angular wings, with far more regular arched inner edging to the border of the primaries. In the dry-season form the border of the secondaries is replaced by dots, but the markings on the under surface are as indistinct as in the wet-season form, the apex of the primaries being very delicately tinted with rose-pink.

15. *Terias Marshalli*, sp. n.

Terias Desjardinsii, Trimen & Marshall (not Boisduval).

Wings much more angular than in the preceding species, the inner edge of the outer border of primaries irregularly sinuated, most prominently on the upper radial and two median interspaces; the outer border of the secondaries usually narrower, always distinctly so in the female and most frequently reduced to a marginal series of spots in that sex; markings below better defined, but especially in the intermediate and dry-season forms, which show an additional irregular subapical brown dash on all the wings and a rusty flesh-coloured border to the primaries. On the upper surface the three tolerably well-defined seasonal types differ chiefly in the width of the dark outer border to the wings, that of the secondaries being reduced in the dry-season to a narrow dentated line in the male and a series of dots in the female. Expanse of wings 35 to 45 millim.

Ranges from the Albert Nyanza southwards to Kaffraria, and on the West Coast from Angola northwards to the Niger. (Fifty examples.)

16. *Terias Desjardinsii*.

♂. *Xanthidia Desjardinsii*, Boisduval, Faun. Madag. p. 22, pl. ii. fig. 6 (1833).

♀. *Terias aliena*, Butler, Ann. & Mag. Nat. Hist. ser. 5, vol. v. p. 337 (1880).

Madagascar.

I believe that this species only has a dry-season form—

the male approaching nearest to the dry form of *T. Marshalli* on the upper surface, but without the rusty or rose-coloured border on the under surface: the female has a faint rosy tinting to the apex above and a more or less dusky ill-defined apical border; on the under surface this sex has both subapical dashes and the apex of the primaries rosy ochreous. The black-tipped white female figured by Mabille in Grandidier's 'Madagascar' does not belong to this section of the genus, but is a variation of *T. hapale*.

17. *Terias punctinotata*.

♀. *Terias punctinotata*, Butler, P. Z. S. 1895, p. 633, pl. xxxv. figs. 8, 9.

The male is bright lemon-yellow, with a black outer border to the primaries, regularly arched internally as in *T. regularis*; it is different from the latter in outline, the costal margin of the primaries being longer and the apex more acute; but for this fact and its much clearer (less deep gamboge) colour I should have concluded that it might be the dry-season form of *T. regularis*, that previously noted being the intermediate form.

18. *Terias mandarinula*.

Terias mandarinula, Holland, Ent. xxv. (Suppl.) p. 91 (1892); Proc. U.S. Nat. Mus. 1895, p. 242, pl. vii. fig. 5.

E. Africa.

I have not seen this species, but can only suppose that it must be allied to the preceding.

SECTION II.

The males characterized by the presence of a patch of thickened scales between the median and submedian veins towards the base of the primaries below and a corresponding subcostal patch on upper surface of secondaries.

This section contains the group to which *T. venata*, *herla*, and *Jaegeri* belong, also *T. smilax* and one unnamed species from the New World.

T. herla group.

Characterized by more or less acutely-pointed primaries, the dry forms usually very ruddy below.

19. *Terias betheseba*.

Terias betheseba, O. Janson, Cist. Ent. ii. p. 272 (1878).
Terias hainana, Moore, P. Z. S. 1878, p. 700.

Yokohama and Hainan.

Our seven examples of this species all belong to the wet-season form, nor have I seen a dry form of this insect.

20. *Terias sana*.

Terias sana, Butler, P. Z. S. 1877, p. 470.

Terias hespera, Butler, Ann. & Mag. Nat. Hist. ser. 5, vol. xvii. p. 214 (1886).

New Guinea to Northern Australia.

T. sana was described upon two small wet-season examples from New Guinea; *T. hespera* upon the dry form from N.E. Australia. The species is represented in the Museum by eleven examples.

21. *Terias venata*.

Terias venata, Moore, Cat. Lep. E. I. C. i. p. 65, pl. 2 a. fig. 2 (1857).

Terias santana, Felder, Reise der Nov., Lep. ii. p. 211 (1865).

Terias rama, Moore, P. Z. S. 1872, p. 566; Lep. Ceylon, i. p. 121, pl. xlv. figs. 5, 5 a (1880-81).

Terias pallitana, Moore, Ann. & Mag. Nat. Hist. ser. 4, vol. xx. p. 48 (1877).

Ranges from the Himalayas southward to Ceylon and probably eastwards through North China, for we have it from Chusan Island and from the Philippines.

The seasonal (?) forms differ less than usual: *T. rama* is probably the best-marked wet type, *T. santana* intermediate, and *T. venata* (of which *T. pallitana* is the female) the dry; but, on the other hand, it is possible that, as seems to be the case in the closely allied *T. betheseba*, no differing dry form may exist, and the slight discrepancies in the pattern of the upper surface or the definition of the markings on the under surface may be partly local and have a subspecific value. The fact that we have the extremes from the Anamully Hills proves that they are not permanently separated as distinct species.

Two males in the Museum from China differ in having the female pattern on the upper surface of the primaries as in *T. læta*.

22. *Terias herla*.

Pieris herla, McLeay, King's Surv. Austr. ii. p. 460 (1827).

Terias lineata, Miskin, P. R. Soc. Queensl. vi. p. 251 (1889).

Northern Australia.

T. lineata is the dry-season form of the species.

23. *Terias læta*.

Terias læta, Boisduval, Sp. Gén. Lép. i. p. 674 (1836).

Terias Jægeri, Ménétriés, Cat. Mus. Petrop., Lép. i. p. 84, pl. ii. fig. 1 (1855).

Terias vagans, Wallace, P. Z. S. 1866, p. 357.

India and Burma.

Differs from *T. herla* chiefly in the more acute apex to the primaries. The wet-season form of the species is *T. vagans*, which the late Capt. Watson says "is possibly wrongly identified in the British Museum"; but, owing to the fact (overlooked by him) that we possess Wallace's type, it was not "possibly wrongly identified." The intermediate form is *T. Jægeri* and the dry form *T. læta*.

24. *Terias subfervens*.

Terias subfervens, Butler, Ann. & Mag. Nat. Hist. ser. 5, vol. xi. p. 278 (1883).

Japan, Southern Korea, and Eastern China.

I based my description upon the extreme dry-season form from Southern Korea, having incorrectly identified the wet and intermediate forms from Japan as *T. Jægeri*. The species may readily be distinguished in all its forms from *T. læta* by the much more prominent and acute apex to the primaries and the distinctly narrower and far more regular black border on the upper surface of these wings.

T. smilax group.

Characterized by the rounded apex to the primaries and far more irregular abbreviated external border to these wings. Donovan's figure is extremely slovenly and does not show this irregularity; indeed it far more nearly resembles a little species which we have from the Bahamas; nevertheless it has been generally admitted that it is intended to represent the intermediate form of the Australian species.

25. *Terias smilax*.

Papilio smilax, Donovan, Ins. New Holl. pl. xx. fig. 3 (1805).

Terias ingana, Wallace, Trans. Ent. Soc. 1867, p. 322; Butler, Cruise of the Curaçoa, p. 470, pl. xlix. fig. 3 (1873).

Terias parvula, Herrich-Schäffer, Stett. ent. Zeit. 1869, p. 78.

Terias varius, Miskin, Proc. Soc. Queensl. vi. p. 259 (1889).

Terias casta, Lucas, op. cit. vol. viii. p. 68 (1894).

Eastern Australia and Baudin Island.

T. casta=*ingana* is the wet-season form, *T. varius* apparently = typical *T. smilax* intermediate, and *T. parvula* the dry form.

SECTION III.

The basal portion of the median nervure of the primaries in the males up to the emission of the first branch edged with thickened scales having an opaque appearance when held to the light.

This section is the most perplexing in the genus and includes all the allies of *T. hecabe* and *T. rahel*.

26. *Terias floricola*.

Xanthidia floricola, Boisduval, Faun. Madag. p. 22, pl. ii. fig. 6 (1833).
Terias ceres, ♂, Butler, Ann. & Mag. Nat. Hist. ser. 5, vol. xvii. p. 218 (1886).

Mauritius and Madagascar.

T. floricola is the wet-season form and *T. ceres* the dry; the female referred by me to *T. ceres* belongs to the following very closely related form, which may perhaps be only a race of the same species, possibly only a variety.

27. *Terias hapale*.

♀ ♀. *Terius hapale*, Mabille, Le Nat. ii. p. 99 (1882); Grand. Madag. pl. xxxii. figs. 6, 7.
 ♂ ♀. *Terias Boisduvaliana*, Mabille, t. c. p. 253, pl. xxxii. figs. 4, 4 a, 5.
 ♂ ♀. *Terias aethiopica*, Trimen, S. Afr. Butt. iii. p. 21 (1889).

Madagascar, Africa generally, Arabia.

T. hapale = *Boisduvaliana* is the wet-season form and *T. aethiopica* = *ceres* ♀ the dry-season form. We have forty-seven examples of this butterfly, and (apart from seasonal variation) they seem to be wonderfully constant, the females only varying in the length of the outer border of the primaries, which, in the variety referred to *T. Desjardinsii* by M. Mabille, is very limited.

28. *Terias anjuana*.

Terias anjuana, Butler, Ann. & Mag. Nat. Hist. ser. 5, vol. xv. p. 189 (1879).
Terias decipiens, Butler, l. c.

Island of Johanna.

T. anjuana is the wet-season form, *T. decipiens* is intermediate, and a small lemon-yellow male which I identified as the W.-African *T. brenda* may possibly be an aberrant dry-season form, but shows none of the characteristic markings on the under surface.

29. *Terias Bewsheri*.

Terias Bewsheri, Butler, Ann. & Mag. Nat. Hist. ser. 5, vol. xv. p. 190 (1879).

Terias chalconiata, Butler, l. c.

Terias dentilimbata, Butler, l. c.

Island of Johanna.

T. Bewsheri is the wet form and *T. chalconiata* and var. *dentilimbata* the dry.

There can be little doubt that this is merely an insular race of *T. senegalensis*, less subject to variation than the continental type.

30. *Terias leonis*.

Terias leonis, Butler, Ann. & Mag. Nat. Hist. ser. 5, vol. xvii. p. 222, pl. v. fig. 6 (1886).

West Africa from Sierra Leone to the Gaboon.

A small species, perhaps doubtfully distinct from *T. senegalensis*, but apparently having no dry-season form; the typical (intermediate) form is more characteristically dissimilar from *T. senegalensis* than the wet form.

There are twenty-eight examples in the Museum series.

31. *Terias senegalensis*.

Terias senegalensis, Boisduval, Sp. Gén. Léop. i. p. 672 (1836).

Terias solifera, Butler, Ann. & Mag. Nat. Hist. ser. 4, vol. xv. p. 396 (1875).

Terias bisinuata, Butler, Ann. & Mag. Nat. Hist. ser. 4, vol. xviii. p. 485 (1876).

Terias orientis, Butler, P. Z. S. 1888, p. 71.

Terias Butleri, Trimen, S. Afr. Butt. iii. p. 23 (1889).

Africa generally, but apparently rare in the south.

T. senegalensis=*solifera* is the extreme wet form; typical *T. senegalensis* having the markings below very indistinct, whereas in *T. solifera* they are well defined: this difference, however, is common as a variation in the genus.

T. orientis=*Butleri* is a less heavily bordered intermediate form, and *T. bisinuata* the dry form, which, however, we have hitherto only received from Eastern Africa.

32. *Terias brenda*.

Terias brenda, Doubleday, Gen. Diurn. Lep. pl. ix. fig. 6 (1847).

Sierra Leone to the Gaboon on the west and the Albert Nyanza to Tanganyika on the east.

This species resembles the preceding in pattern in all its forms excepting that the secondaries are less frequently

bordered with black above, being usually dotted at the ends of the nervures. It differs chiefly in colouring, the wings being bright lemon-yellow above instead of gamboge. The largest examples of *T. brenda* show a somewhat greater expanse of wings than the largest examples of *T. senegalensis*, but size alone is of little consequence.

33. *Terias anemone*.

Terias anemone, Felder, Wien. ent. Monatschr. vi. p. 23 (1862).

Terias mandarina, De Lorza, Lep. Jap. p. 18 (1869).

Terias Mariesii, Butler, Trans. Ent. Soc. 1880, pl. vii. figs. 1-6.

Terias hybrida, Butl. l. c. figs. 7-11.

Terias connexiva, Butl. l. c. figs. 12-15.

Japan and Chusan Island, round the south-eastern coast of China from Shanghai to Hong-Kong.

T. Mariesii is the wet-season form, *T. anemone*, *hybrida*, and *connexiva* intergrades, and *T. mandarina* the dry-season form.

The transitions from wet to dry affect both surfaces simultaneously in this species, and thus at once distinguish it from *T. hecabe* and *T. suava*, in which the upper surface varies enormously at all seasons. The wet form (*T. Mariesii*) differs from the parallel variety of the wet form in *T. suava* in the more abrupt costal termination of the apical patch on the upper surface. Our series of this species is represented by 127 selected examples.

34. *Terias Hobsoni*.

Terias Hobsoni, Butler, P. Z. S. 1880, p. 668.

S.E. Corea, Japan, the Chusan Archipelago, Eastern China from Hang-Chow southwards to Foo-Chow and Formosa.

It is possible that this may be a variation of the preceding species, in which the outer border is equally well marked on the primaries, but wanting on the secondaries: the dry form is unknown to me.

35. *Terias unduligera*.

Terias unduligera, Butler, P. Z. S. 1880, p. 668.

Foo-Chow and N. Formosa.

The dry form is quite unlike that of *T. anemone*, approaching closely to that of *T. hecabe*. It is possible that this may be inseparable as a species from *T. hecabe*, from which it differs much as *T. nicobariensis* does from *T. suava*; it does

not, however, quite correspond with *T. hecabe* in pattern in any of its seasonal forms, and appears to be locally constant.

Cramer's *Pap. hecabe* (Pap. Ex. vol. ii. pl. cxxiv. figs. B, C) probably represents the intermediate form of *T. unduligera*.

36. *Terias hecabe*.

Papilio hecabe, Linnæus, Mus. Lud. Ulr. p. 249 (1764).

Terias blanda, Boisduval, Sp. Gén. Léop. i. p. 672 (1836).

Terias æsiope, Ménétriés, Cat. Mus. Petrop., Léop. i. p. 85, pl. ii. fig. 3 (1855).

Terias subdecorata, Moore, P. Z. S. 1878, p. 699.

Terias arcuata, Moore, t. c. p. 700.

South China from Hong-Kong to Tonkin, including the island of Hainan.

In this species the wet-season form appears to vary very little, but the intermediate and dry forms exhibit considerable variation in the width of the outer border of the primaries. *T. æsiope* is a dry form corresponding with the wet-season form (*T. hecabe*); in *T. subdecorata* the only difference of importance is in the much less angular upper inner margin to the apical portion of the outer border; in *T. blanda* the inner edge of the outer border is almost or often quite regularly arched, and *T. arcuata* appears to be the same thing with an intermediate character of under surface. The following, which may prove to be a further development of the dry-season form of *T. hecabe*, was also described from Hainan; but the Museum possesses only a pair, presumably of this species, from the Loo-choo and Madjico-sima Islands; therefore, for the present, I keep it separate.

37. *Terias attenuata*.

Terias attenuata, Moore, P. Z. S. 1878, p. 700.

Hainan; also ? Loo-choo and Madjico-sima groups.

It is of course possible that our examples, in spite of their resemblance to Dr. Moore's insect, may prove to be the dry form of *T. Hobsoni*; their habitat seems to render this more likely than that they should be a variation of the Southern Chinese species.

38. *Terias suava*.

Terias suava, Boisduval, Sp. Gén. Léop. i. p. 670 (1836).

Terias hecabeoides, Ménétriés, Cat. Mus. Petrop., Léop. i. p. 85, pl. ii. fig. 2 (1855).

Terias fimbriata, Wallace, Trans. Ent. Soc. ser. 3, vol. iv. p. 323 (1867).

Terias simulata, Moore, Lep. Ceylon, i. p. 119, pl. xlv. figs. 2, 2 a, 2 b (1881).

Terias excavata, Moore, P. Z. S. 1882, p. 252.

Terias irregularis, Moore, t. c. pl. xii. fig. 3.

Terias apicalis, Moore, t. c. p. 253, pl. xii. fig. 2.

Terias asphodelus, Butler, P. Z. S. 1883, p. 151, pl. xxiv. fig. 13.

Terias narcissus, Butler, l. c.

Terias Swinhoei, Butler, Ann. & Mag. Nat. Hist. ser. 5, vol. xvii. p. 216 (1886).

Terias simplex, Butler, t. c. p. 217, pl. v. fig. 2.

Terias contubernalis, Moore, Journ. Linn. Soc., Zool. xxi. p. 46 (1886).

Terias patruelis, Moore, t. c. pl. iv. fig. 5.

Terias fraterna, Moore, t. c. pl. iv. fig. 6.

Terias Andersonii, Moore, t. c. p. 47, pl. iv. fig. 8.

India and Ceylon, Burma, and southward to Malacca, including the Mergui Archipelago.

This species well bears out Darwin's statement that common and widely distributed species vary most. *T. suava* (commonly confounded with the broader-winged and far less variable *T. hecabe* of S. China) exhibits more inconstancy than any other species of *Terias*, and consequently has received numerous distinctive names. As every gradation of upper-surface pattern, from the typical broad-bordered *T. suava* to the narrow-bordered *T. narcissus*, is represented at all seasons, it would seem to a superficial observer that many species were represented by the forms of this butterfly; when, however, it is found that these forms are not limited to locality and comprise a perfect transitional series, it becomes evident that they represent one extremely variable species.

In order to facilitate their identification I shall consider these intergrades as separate varieties, beginning with the most broadly bordered typical form and ending with those in which the border is reduced to its narrowest limit.

Var. 1.

T. suava=*hecabeoides* is the wet-season form, the intermediate form is unnamed; *T. simulata* is the dry-season form, from which *T. contubernalis* is practically inseparable.

Var. 2.

T. merguiana is the wet-season form, the intermediate form is unnamed; *T. excavata* is the dry-season form, from which *T. Andersonii* is inseparable.

Var. 3.

The wet and intermediate forms are both unnamed; *T. fraterna* is the dry form.

Var. 4.

The wet and intermediate forms are both unnamed; *T. purreea*=*patruelis* is the dry form.

Var. 5.

The wet and intermediate forms are both unnamed; *T. Swinhoei* is the dry form.

Var. 6.

The wet form is unnamed, the intermediate form is unknown to me; *T. asphodelus* and *irregularis* are small and large types of the dry form.

Var. 7.

The wet form is unnamed; *T. fimbriata* is the intermediate form, and *T. narcissus* the dry form.

Var. 8.

The wet and intermediate forms are unknown; *T. simplex* is the dry form.

Var. 9.

The wet and intermediate forms are unknown; *T. apicalis* is the dry form.

39. *Terias nicobariensis*.

Terias nicobariensis, Felder, Verh. zool.-bot. Ges. Wien, xii. p. 480 (1862).

Terias phanospila, Felder, Reise der Nov., Lep. ii. p. 209 (1865).

Andamans, Nicobars, Java, Sumatra, Flores (coll. Hewitson), Borneo, and the Philippines. We have a female apparently referable to the intermediate form of this species, but said to have been taken in Ceylon.

To my mind *T. nicobariensis* is more nearly related to *T. silhetana* than to *T. suava* (with which, under the incorrect name of *T. hecabe*, it has been associated by Indian workers).

T. phanospila was based upon old discoloured males from Java; we have exactly similar specimens from Horsfield's collection. This is the dry-season form of the species.

40. *Terias silhetana*.

Terias silhetana, Wallace, Trans. Ent. Soc. ser. 3, vol. iv. p. 324 (1867).

Terias citrina, Moore (not Poey), Lep. Ceylon, i. p. 119, pl. xlv. figs. 4, 4 a (1881).

Terias rotundalis, Moore, t. c. p. 120, pl. xlv. figs. 1, 1 a, b (1881).

Terias uniformis, Moore, l. c. figs. 2, 2 a, b (1881).

Terias vallivolans, Butler, Ann. & Mag. Nat. Hist. ser. 5, vol. xi. p. 420 (1883).

Terias heliophila, Butler, Ann. & Mag. Nat. Hist. ser. 5, vol. xvi. p. 338, pl. viii. fig. 2 (1885).

Terias Templetoni, Butler, Ann. & Mag. Nat. Hist. ser. 5, vol. xvii. p. 218 (1886).

Terias simulatrix, Semper, Reisen Arch. Philipp. ii. vol. v. pl. xli. figs. 7-9 (1891).

Terias tecmessa, De Nicéville, Journ. Asiat. Soc. Bengal, lxiv. p. 498 (1896).

Burma, Pegu, N.E., Central, and Southern India, Ceylon, Andamans, N.E. Sumatra, Philippines *.

The character by which the late Capt. Watson proposed to distinguish *T. silhetana* from other species of the *T. hecabe* group is that it has an extra black dot near the base of the discoidal cell on the underside of the primaries. Unfortunately this character is not always present, though usually so in the narrow-bordered forms of the species.

T. silhetana separates fairly easily into two types, the first with a broad border to the secondaries at all seasons, the second with a narrower border in the wet-season, which almost or quite disappears in the dry-season.

Broad-bordered type.

The wet-season form is unnamed; the dry-season form is *T. citrina*=*T. simulatrix*=*T. tecmessa* (the latter being the drier and commoner variation).

Narrow-bordered type.

The wet-season form is *T. rotundalis*=*vallivolans*=*Templetoni*; the intermediate form is *T. heliophila*; the dry-season form is *T. silhetana*=*T. uniformis*.

41. *Terias Moorei*.

Terias Moorei, Butler, Ann. & Mag. Nat. Hist. ser. 5, vol. xvii. p. 216, pl. v. fig. 1 (1886).

Camorta.

The late Capt. Watson regarded this as an extreme variety of *T. silhetana* (to which, as my figure shows, it bears not the faintest resemblance), solely on the ground that the black dot, which he believed to be confined to *T. silhetana*, occurs in our two examples, although not in the same part of the cell. As a fact, the cell-markings on the under surface of the species of *Terias* are eminently variable both in number and position, sometimes on opposite wings of the same individual.

* We have a female said to have been obtained at Afghanistan over fifty years ago; but this is probably an error.

42. *Terias kana*.

Terias kana, Moore, Journ. Linn. Soc., Zool. xxi. p. 48, pl. iv. fig. 9 (1886).

Terias toba, De Nicéville, Journ. Asiat. Soc. Bengal, lxiv. p. 496 (1896).

Mergui Archipelago and Sumatra.

An intermediate-season form (of which the wet and dry forms are unknown to me). Capt. Watson thought that *T. kana* might be the wet-season form of *T. sari*; but we have what I believe to be the wet form of (the race?) *T. sodalis* from Ceylon, and it agrees with the latter exactly in the pattern of the upper surface, whereas *T. kana* is more like a small broad-bordered *T. suava*.

43. *Terias curiosus*.

Terias curiosus, Swinhoe, P. Z. S. 1884, p. 508, pl. xlvii. fig. 3.

Karachi.

The late Capt. Watson regarded this as an aberration of "*T. hecabe*," but to my mind it has far more the character of *T. sodalis*; it may be distinct from either, and (in the absence of evidence) I therefore leave it.

44. *Terias sari*.

Terias sari, Horsfield, Cat. Lep. E. I. C. p. 136 (1829).

Terias sodalis, Moore, Journ. Linn. Soc., Zool. xxi. p. 45 (1886).

Ceylon, Nilghiris, Burma, Mergui Archipelago, Malacca, Sumatra, Java, Borneo, Sulu Archipelago, Palawan.

The examples from the mainland and Mergui, as well as the wet-season examples from Ceylon, have usually a narrower border to the secondaries, though one example from Malacca has this border fairly broad; these would represent *T. sodalis*. The forms from Sumatra northwards to Palawan have this border somewhat broader and are typical *T. sari*. Both names were given to the dry-season phase.

45. *Terias sarilata*.

Terias sari, var. *sarilata*, Semper, Reisen Philipp. ii. v. pl. xii. figs. 10-12 (1891).

Davao, Philippines.

Only the dry form is known to me.

Var. ? *mindorana*.

Two females. The outer borders of the wings above occupying from one third to two fifths of the wing-surface;

that of the primaries acutely angulated below costa, the bisinuation on the median interspaces more transverse and with diffused outer edge; a blackish-brown streak continuous with the border running inwards to a third of the distance from the base along the inner margin; the chocolate apical patch on the under surface narrower than in females of typical *T. sarilata*.

Mindoro. From the Godman and Salvin collection.

If males from Mindoro exhibit similar differences, this may be regarded as a distinct species; but our two females are not quite alike (as indicated in the above description). Both belong to the dry-season phase.

46. *Terias semifusca*.

Terias semifusca, Butler, Ann. & Mag. Nat. Hist. ser. 5, vol. xvii. p. 222, pl. v. fig. 8 (1886).

Sumatra. Type coll. Hewitson.

Belongs to the intermediate seasonal phase.

47. *Terias bidens*.

Terias bidens, Butler, Ann. & Mag. Nat. Hist. ser. 5, vol. xvii. p. 222, pl. v. fig. 7 (1886).

Sumatra. Type coll. Hewitson.

Is also an intermediate form.

48. *Terias latilimbata*.

Terias latilimbata, Butler, Ann. & Mag. Nat. Hist. ser. 5, vol. xvii. p. 221, pl. v. fig. 5 (1886).

Sumatra. Type coll. Hewitson.

A wet-season form.

49. *Terias latimargo*.

Terias latimargo, Hopffer, Stett. ent. Zeit. 1874, p. 25.

Terias anguligera, Butler, Ann. & Mag. Nat. Hist. ser. 5, vol. xvii. p. 224, pl. v. fig. 10 (1886).

Celebes and Flores.

We have the wet-season form in the Museum series and the wet and intermediate forms in the Hewitson collection.

50. *Terias diversa*.

Terias diversa, Wallace, Trans. Ent. Soc. ser. 3, vol. iv. p. 324 (1867).

Philippines.

This appears to be the species figured by Semper (figs. 15-17) as *T. hecabe*; his figs. 13 and 14 do not seem to me to

be distinct from his *T. simulatrix*, differing markedly from all the seasonal forms of *T. diversa*.

51. *Terias sulphurata*.

Terias sulphurata, Butler, P. Z. S. 1875, p. 617.

Terias variata, Butler, *l. c.*

Terias hebridina, Butler, *t. c.* pl. lxvii. fig. 8.

Terias inanata, Butler, *l. c.*

Terias pumilaris, Butler, *t. c.* pl. lxvii. fig. 7.

Terias sinapina, Butler, Ann. & Mag. Nat. Hist. ser. 4, vol. xx. p. 355 (1877).

Terias lifuana, Butler, *l. c.*

Terias aprica, Butler, Ann. & Mag. Nat. Hist. ser. 5, vol. xi. p. 420 (1883).

Terias maroensis, Butler, P. Z. S. 1883, p. 368, pl. xxviii. fig. 2.

Terias laratensis, Butler, *t. c.* p. 369, pl. xxviii. fig. 3.

Terias photophila, Butler, Ann. & Mag. Nat. Hist. ser. 5, vol. xiii. p. 196 (1884).

Terias phæbus, Butler, Ann. & Mag. Nat. Hist. ser. 5, vol. xvii. p. 221, pl. v. fig. 4 (1886).

Ranges from Northern Australia northwards to Timor Laut, Aru, and New Guinea, and thence eastwards to New Ireland, appearing just to touch the Solomons; more to the south it ranges eastwards to the Loyalty, New Hebrides, and Fiji Islands.

This species exhibits a more restricted variability than *T. suava*, which it doubtless replaces in Australasia; the mode of variation is, however, similar. Regarded as a whole it is a smaller type, never so heavily bordered or suffused with blackish as typical *T. suava* nor so narrowly bordered as *T. apicalis*.

The varieties with their seasonal forms are as follows:—

Var. 1.

The wet-season form is *T. photophila*, with the outer border slightly narrower in *T. hebridina*, the upper angle of the sinus rounded off and the border of secondaries very narrow or reduced to dots in *T. inanata* and *aprica* (the latter is larger than *T. inanata* and has the margin of secondaries dotted). The intermediate form of this variety is unnamed. The dry-season form is *T. maroensis*=*phæbus*, of which *T. sulphurata* and *variata* are narrower bordered examples, the latter small and with dotted margin to the secondaries.

Var. 2.

The outer border of primaries broad at apex, but narrow at external angle; the seasonal forms are unnamed.

Var. 3.

The outer border of primaries much narrower throughout. The wet-season form is *T. pumilaris* (starved) and *T. sinapina* (full-sized); intergrades between the two extremes are in the Museum series. The intermediate form is *T. lifuana* = *T. laratensis* (the differences very slight) and the dry form is unnamed.

52. *Terias brevicostalis*, sp. n.

Readily distinguishable from all species of this group by the short costal margin to the primaries and the more rounded outer margin; the apical portion of the external border is consequently narrowed, just as though its outer edge had been trimmed off; the subapical angle of this border is more obtuse than usual, the secondaries are subangulated at the end of the second median branch; the outer border of the secondaries is well-defined, regularly sinuated internally, but varies somewhat in width and length; the general colour of the male above is saffron-yellow and that of the female citron-yellow; the markings below are normal, but not very strongly defined in the wet and intermediate forms; the dry form is unknown to me.

Expanse of wings 41-47 millim.

Semão Island, Timor (coll. Hewitson), Wetter, (probably Bourou), Batchian, Ternate, and Gilolo.

The general aspect of the males is that of the *T. Desjardinsii* group rather than of the *T. hecabe* group.

53. *Terias biformis*.

♂ ♀. *Terias biformis*, Butler, Ann. & Mag. Nat. Hist. ser. 5, vol. xiii. p. 196 (1884).

♀. *Terias lacteola*, Distant, Rhop. Mal. p. 466, fig. 129 (1886).

♀. *Terias ada*, Distant, Ann. & Mag. Nat. Hist. ser. 5, vol. xix. p. 271 (1887).

Ranges from Nias through Borneo eastwards to Ternate and Batchian, extending south to Amboyna and Ceram, and probably crossing New Guinea, to reappear in the Louisiade and Solomon groups.

The males of this *Terias* seem to run very close to those of *T. sulphurata*, of which species I should be inclined to regard it as a variety but for the white or creamy colouring of the females. In the Solomon group this type of female seems to be abundant, whereas the yellow female of *T. sulphurata* seems to be extremely rare; from Amboyna again I have only seen white females. In the Solomon Islands the females

would seem to be most prevalent between the wet and dry seasons, nor have I seen a single dry-season male.

T. biformis was based upon a male with dry-season upper surface and a typical wet-season female; the former has usually a very narrow outer border, and sometimes the base and edge of the inner margin are irrorated with dusky scales, so as to approach the least pronounced forms of the *T. rahel* group.

T. lacteola and *ada* were both based upon females, the first white, the second creamy or with a faint tint of sulphur; the outline of the border of the primaries and the dusky irroration of the upper surface are characters which vary much in this species. Our series of *T. biformis* is now represented by seventy-one examples.

The names *T. biformis*, *multifrons*, and *multiformis*, proposed by the late Mr. H. Pryer for *T. subfervens* and *T. mandarina*, were given in defiance of the law of priority, and, but for the fact that they have recently been quoted by a scientific worker, I should simply have ignored them, as I should the names ignorantly given in a story-book. Not only was the name *T. biformis* proposed in 1887 for a butterfly which Mr. Pryer believed to have several names already, but it was given as the name of two species which Mr. Pryer believed he had bred (and which a friend of his was satisfied he had not bred) from one another. Lastly, the name *T. biformis* was given in ignorance of the fact that it had already been employed in the same genus about three years and a half previously.

With regard to his *T. multifrons*, subsequently altered without comment to *T. multiformis*, Mr. Pryer believed that it included no less than ten forms, all of which he declared that he had bred from eggs laid by *T. mandarina*, although most of them never were seen in Japan, and one, at any rate, is a well-known West-African species. Subsequently Pryer extended the species to include what he called *T. læta* (meaning *T. subfervens*), the wet and dry forms of which he probably regarded as *T. læta* and *betheseba*, or *T. læta* and *Jægeri*, according to fancy.

When it is remembered that the *T. læta* group is characterized by entirely different male sexual marks from the *T. hecabe* group, the fact that Pryer believed he had bred one from the other invalidates the whole of his breeding experiments, proving them to have been far more careless than the positive assertions of this collector would fain constrain us to believe them.

54. *Terias indecisa*, sp. n.

♂. Gamboge-yellow; the primaries having the base blackish, the costal margin very narrowly grey, the apex and a narrow external border dark brown, trisinuated internally as in *T. gradiens*, with a slight widening at external angle, but without a trace of the internal border characteristic of the *T. rahel* group; secondaries with a dentate sinuate external border, a little broader than in *T. tilaha* and more diffused towards the anal angle: wings below slightly paler than above, with the characteristic markings of the *T. hecabe* group (wet-season) represented by brown scales and not strongly defined.

Expanse of wings 45 millim.

Batchian (*Wallace*).

This seems to be a link between the *T. hecabe* and *T. rahel* groups; its upper-surface pattern is characteristic of an intermediate or dry-season form, but that of the under surface proves it to be a wet-season form. This insect is so very distinct from any other described form that, although slightly discoloured with age, I am constrained to regard it as new to science.

T. rahel group.

The inner border of the primaries and sometimes the abdominal border of the secondaries more or less broadly bordered with deep brown; in some species these and the ordinary borders are so much extended as to occupy the greater portion of the upper surface, leaving only a patch of yellow on each wing, whilst in the females even these patches are sometimes irrorated with brown.

55. *Terias sinensis*.

Terias sinensis, Lucas, Rev. et Mag. de Zool. 1852, p. 429.

"China" (*Lucas*); Sulu Archipelago. ♂, B. M.

Our single example agrees well with the description. It approaches very near to the type of *T. gradiens* from Borneo, but differs in its slightly longer wings and narrower borders. It is a wet-season form.

56. *Terias gradiens*.

Terias gradiens, Butler, Ann. & Mag. Nat. Hist. ser. 5, vol. xvii. p. 223, pl. v. fig. 9 (1886).

Borneo, Sandakan.

Our male from Sandakan has the inner border of the

primaries more equal in width than in the type. The wet-season form only is known.

57. *Terias tilaha*.

♀. *Terias tilaha*, Horsfield, Cat. Lep. E. I. C. p. 136 (1829).

Java and Borneo.

Our ten examples are quite uniform in character and belong to an intermediate-season phase. The greater size, much broader apical border of primaries, the more elongated sinus in the border on the lower median interspace, and the extension of the inner border so as to impinge upon the discoidal cell at its base render it next to impossible that this can be the intermediate form of the preceding species, for we know that the change from a wet- to a dry-season character in this genus is usually accompanied by a decrease in the dark borders of the upper surface, and never by an increase in their width. When any change in size takes place, it tends towards diminution of expanse in the dry season.

58. *Terias Nicevillei*, sp. n.

I believe this to be the *T. tilaha* of De Nicéville; it is the smallest species of the group; it differs in pattern from *T. tilaha* in the slightly more regular inner oblique edging to the apical border of the primaries, the slightly narrower outer border of the male secondaries and the broader border to those of the female; the latter sex is also much deeper in colour than in *T. tilaha*, being nearly as bright a yellow as the male; the under surface is similar to that of *T. tilaha*.

Expanse of wings 38 millim.

N.E. Sumatra (from Capt. E. Y. Watson's collection).

59. *Terias rahel*.

Papilio rahel, Fabricius, Mant. Ins. ii. p. 22 (1787).

Borneo.

This is the Bornean representative of *T. tondana*, from which it differs in having the pattern of the primaries more nearly like that of *T. tilaha* and the pattern of the secondaries nearly alike in both sexes; whereas the female of *T. tominia* differs widely from its male in all the wings. The abdominal border of the secondaries is less strongly marked than in *T. tominia*. This, again, is an intermediate form in the under-surface markings.

60. *Terias tominia*.

♀. *Terias tominia*, Vollenhoven, Mon. Pier. p. 66, pl. vii. fig. 4 (1865).
 ♂ ♀. *Terias tondana*, Felder, Reise der Nov., Lep. ii. p. 214, pl. xxvi.
 figs. 1, 2 (1865).

Menado, Minahassa. B. M.

A wet-season form.

In the Berl. ent. Zeitschr. vol. xlii. p. 8 (1897), Herr Frühstorffer indicates the existence of a new species allied to *T. tominia* from Lombock; for this he proposes the name of *T. lombokiana*.

61. *Terias talissa*.

♀. *Terias talissa*, Westwood, Trans. Ent. Soc. 1888, p. 469, pl. xii.
 figs. 1, 1 a.

Celebes, Minahassa. B. M.

The female (of which we have both wet and intermediate forms) differs chiefly from that sex of *T. tondana* in the narrower and more smoky-yellow belts on the wings; the male, however, is widely different, the yellow area on the primaries being reduced to a broad oblique belt and that of the secondaries bounded behind by the median vein. Considering the constancy of the species in this group, we have at present no grounds for supposing that *T. tominia* alone should vary to this extraordinary extent; therefore, in spite of the general similarity of the females and the fact that both types appear to occur in the same islands, they must, for the present at any rate, be regarded as different species.

62. *Terias celebensis*.

Terias celebensis, Wallace, Trans. Ent. Soc. ser. 3, vol. iv. p. 327, pl. vi.
 fig. 1 (1867).

Tondano, Macassar, Sula Islands.

Wallace gives the locality of his male as "Menado," but the only male from the Wallacean collection in Hewitson's cabinet is labelled "Tond." The female from the Sula Islands differs from that obtained at Macassar in having the outer half of the primaries black; it would be interesting to see whether this difference was constant. The male would be best described as having the primaries above like those of *T. sari* and the secondaries like those of *T. tominia*. All the specimens have an intermediate season character of under surface.

63. *Terias alitha*.

Terias alitha, Felder, Wien. ent. Monatschr. vi. p. 289 (1862).

Terias invida, Butler, Ann. & Mag. Nat. Hist. ser. 5, vol. xi. p. 418 (1883).

Philippines, Sula Islands.

I believe *T. alitha* to be the wet-season form, though the female shows an intermediate character of under surface, and *T. invida* the dry-season form, although the male does not differ on the under surface from that of the wet season, and is only separable by the reduced width of the black borders above. A very broad-bordered form occurs, of which we have six examples from Samboangan and Davao, which may possibly be distinct, as well as a pair similar to the last but with the yellow area of the primaries abbreviated. I dare not venture, without proof of their distinctness, to name these forms, all of which, if distinct, should have been named by Mr. Semper in his Butterfly Fauna of the Philippines ('Reisen im Archipel der Philippinen,' Band v.).

64. *Terias Lorquini*.

Terias Lorquini, Felder, Reise der Nov., Lep. ii. p. 209 (1865).

Macassar, Celebes.

A wet-season form.

65. *Terias zita*.

♂. *Terias zita*, Felder, Reise der Nov., Lep. ii. p. 210 (1865).

♀. *Terias zama*, Felder, *l. c.*

Celebes, Ternate.

The males in the Museum have a wet- and the female a dry-season character of under surface; excepting in colour they are alike in the pattern of the upper surface.

66. *Terias eumide*.

Terias eumide, Felder, Reise der Nov., Lep. ii. p. 214 (1865).

Celebes, Batchian, Amboyna.

We have seasonal types of this species; but in the *T. rahel* group generally there is something undecided about the various phases of the species, which makes one doubt whether the species of this group ever exhibit well-defined seasonal forms such as exist in all the other groups of the genus; possibly they may be in a transitional stage towards extinction, for I believe that they have not been developed by changes of temperature, but have simply been adapted to them, inasmuch as

they are often all well-marked and emerge simultaneously in countries where practically no wet-season exists; but, on the other hand, in countries where the weather is more or less moist throughout the year the dry forms are either wholly absent or are extremely rare (probably only existing as reversional sports).

T. amplexa group.

In this group the outer borders are quite regular—that is to say, not widening towards the apex of the primaries, as in the extreme dry phases of the *T. hecabe* group.

67. *Terias amplexa*.

Terias amplexa, Butler, P. Z. S. 1887, p. 523 (with cut).

Christmas Island.

Our males are all of the wet-season type, and our single female of the dry-season, in the pattern of the under surface.

X.—*A Revision of the Linnean Type Specimens of Scorpions and Pedipalps in the Zoological Museum of the Royal University at Upsala.* By Dr. EINAR LÖNNBERG.

FROM the time of Linnæus three Scorpions and two Pedipalps have been preserved in the Zoological Museum at Upsala. They were all five mounted on pins by Thunberg, and are provided with his handwritten labels, which not only give the specific name, but also define the "collection" to which they belonged. It is consequently easy to find the names in the catalogues written by Thunberg. The first scorpion among these is labelled "*afer*, Mus. Ad. Fr.," which means that it belonged to the collection which the then Crown Prince Adolph Fredrik presented to the University in 1745. This collection was afterwards described by Linnæus in the 'Dissertatio Academica,' which was defended by L. Balk, 31st May, 1746, in a work entitled 'Museum Adolpho-Fridericianum'*, and reprinted in 'Amœnitates Academicæ,' t. i. no. xi. pp. 277–326, under the title 'Museum Principis.' Here we also find the scorpion as No. 61 "*Scorpio pectinumdenticulis XIII.*" The specimen in question is thus a type, or one of the types, of the "*Scorpio afer*," which in Syst. Nat. ed. x. (1758) p. 624, and ed. xii. (1767) p. 1038, as well

* This must not be confounded with the 'Museum Adolphi Friderici Regis,' printed in Stockholm, 1754.

as in 'Mus. Ludov. Ulr. Reginae' (1764), p. 429, bears that name. In all these books "*S. afer*" is said to have thirteen toothed combs, as has also the type specimen, thus in this, as in every other respect, agreeing with the description given in 'Museum Principis.' It is possible, perhaps probable, that the "*Scorpio afer*" of Linnæus was a collective name, as has been supposed by many later authors. The words in 'Mus. Lud. Ulr. Reg.' p. 429—"Chelæ cordatæ adspersæ Punctis eminentibus. . . ."—seem to give support to this supposition. Perhaps this refers to a scorpion with granulate chelæ—for instance, *S. ceylonicus*, Herbst (= *Buthus megacephalus*, C. L. Koch) *. The real type specimen from 'Museum Principis' is, however, the Javan species *Buthus reticulatus*, C. L. Koch, or, as it is called in Kræpelin's 'Revision der Scorpione' † (p. 53), "*Scorpio indicus*, L." In examining this scorpion Thorell has come to the same conclusion in his "Etudes Scorpiologiques" ‡, pp. 208–209. He seems, however, not to have any faith in Thunberg's labels, and therefore he only uses the name "*afer*" as a synonym. It is true that Thunberg has sometimes changed a Linnean name to another of his own invention, but he always gives correct information about the origin of the specimens—that is, to which collection they have belonged—and he has given a very good account in his catalogues of this matter. There cannot then be any doubt that the animals labelled by Thunberg as belonging to Linnean collections really do so. But Thorell also thinks that Linnæus has mixed up two (or perhaps more) species of scorpions. In older books, as in Syst. Nat. ed. vi. (1748) p. 68, Linnæus mentions an Asiatic "*Scorpio indicus*" with thirteen teeth in the combs and an African "*Scorpio africanus*" with eighteen comb-teeth. This statement concerning the Indian scorpion induces Kræpelin to propose (l. c. p. 54) to make for once an exception and use the name from ed. vi., because "*indicus*" is more suitable from a geographical point of view, and he calls the Javan scorpion "*S. indicus*, Linn." Such a violation of the accepted rules of nomenclature is, however, dangerous, as it conduces to further excesses, and, although it seems rather enticing in this case, it must be resisted. In 'Mus. Ad. Frid. Reg.' (1754) p. 84, we also find both the names "*africanus*" and "*indicus*"; but to the former a new diagnosis is given, as the comb-teeth are

* This is the more probable as there is in Thunberg's collection a specimen of this kind labelled "*afer*."

† Jahrb. wiss. Anst. Hamburg, 1893.

‡ Att. Soc. It. vol. xix. (Milano, 1877).

said to be twelve in number. But even this publication is earlier than the introduction of binomenclature, and although two names are practically used already in this work, they are not, according to the prevalent rules, so well sanctioned as those in the tenth edition and later. For this reason it does not seem advisable to adopt, with Thorell, the name "*africanus*" and use that for an African species of scorpion, especially when one has not more guidance for the fixation of the name than the words "Habitat in Africa" and the statement concerning the number of comb-teeth—"pectinibus duodecim dentatis"—which may even more easily be referred to other species than to the common African one. Besides, it must be well observed that the notes written by Linnæus concerning the habitats of the animals described are unfortunately very often erroneous. For this many proofs could be given. Why the errors in that respect are so numerous is easy to understand if we take into consideration how the collections of those days were made and other circumstances. Firstly, the geographical origin of the specimens seemed to be of little or no importance, because zoogeography was not as yet included among the branches of scientific natural history. Secondly, the specimens in the museums of the time before Linnæus were not, as a rule, brought together by scientifically educated persons who made journeys in foreign countries for the purpose of studying the fauna and flora as well as of making collections of specimens. The "museums" of those days, which belonged to princes and other great and wealthy people, were rather store-rooms for curiosities ("cabinets de curiosité") where all kinds of strange things were gathered together, not for scientific use or the advancement of knowledge, but as a kind of luxury. The specimens themselves were obtained from seamen or travelling merchants who brought home peculiar objects from the countries they had visited and sold or presented them to their patrons. The information concerning the geographical origin was based upon hearsay, and was, naturally enough, untrustworthy. Under such circumstances it is evident that the statements or notes on the habitats given by Linnæus must be very uncertain, especially when he described a collection which was already brought together from all parts of the world, such as 'Mus. Ad. Frid. Reg.' or 'Mus. Ludov. Ulr. Regina.' It was altogether different when the objects to be described were brought home by some of the pupils of Linnæus, who had visited certain countries for zoological and botanical purposes. From this we can judge that if "Linnæus" has given an animal the name "*afer*" or

"*africanus*," he believed it to originate from Africa, but certainly not that it really did so. The account of habitat can therefore be used only with the utmost discretion, and even then often with great uncertainty, for the identification of Linnean species of animals. How uncertain Linnæus himself was is shown very plainly by the fact that, under the name "*Scorpio afer*" in Syst. Nat. ed. x., he writes "Habitat in India," but in 'Mus. Ludov. Utr. Reginæ' under the same name has "Habitat in Africa," and, again, in Syst. Nat. ed. xii. "Habitat in India," although 'Mus. Lud. Utr. Reg.' is quoted! For all these reasons I maintain that the name "*afer*" (as well as "*africanus*") cannot be proved to belong to the common African scorpion. But when we have an unquestionable Linnean type specimen, which is labelled "*afer*" and is described with a diagnosis agreeing with that which, after the establishment of binomenclature, is given by Linnæus under that same name, I think it cannot be disputed that the species of scorpion which is represented by the said Linnean type specimen must be called

Scorpio afer, Linnæus (p. p.).

1838. *Buthus reticulatus*, C. L. Koch.

1877. *Pandinus indicus* (Linn.), Thorell.

1894. *Scorpio indicus* (Linn.), Kræpelin.

(For other synonyms see Kræpelin, l. c.)

It is exceedingly unfortunate that an East-Indian or Javan species should be called "*afer*," but it cannot be helped, and many corresponding instances could be enumerated; for many specific names involve an erroneous geographical denomination, and many more give the animals a character which they do not, or only exceptionally, possess; but such names cannot, however, be abolished or altered. The names "*africanus*" and "*indicus*" cannot be given to any species of scorpion with Linnæus as author, because it is quite impossible to say where they belong. The scorpion that is commonly called "*Scorpio africanus*, Linn.," thus ought to have its name changed; and if (*Buthus*) *imperator*, C. L. Koch, as Kræpelin thinks, is identical, this name is the oldest given, otherwise (*Heterometrus*) *Ræselii*, Simon, has precedence. This latter is also the opinion of Pocock*, who, although with a certain hesitation, regards "*Scorpio africanus*," Linn. (1754, Mus. Ad. Frid. Reg.), as identical with an African scorpion described by him (Pocock) under the name "*dictator*" (l. c.

* "On African Specimens of the Genus *Scorpio*," Ann. & Mag. Nat. Hist. ser. 6, vol. ii. pp. 245-255.

p. 251). The small number of comb-teeth in Pocock's *S. dictator*, namely nine to thirteen, seems perhaps to indicate its identity with Linnæus's "*S. africanus*" (1754), which is said to have twelve. The whole subject is, however, too obscure, and besides, since binomenclature was not established in 1754, there is no reason to alter Pocock's name.

The two other scorpions dating from the time of Linnæus are labelled by Thunberg "Mus. Lin.," which, according to the catalogues, means that they belong to "Donatio Jonæ Alströmer nec non Caroli a Linné" from 1749 "et sequentibus annis." As these specimens have not been described by Linnæus in any special separate publication, they have not quite the same value. They are, however, nevertheless very important, as it is quite certain that they were seen and studied by Linnæus; and it is possible that they are types of the diagnoses in Syst. Nat., especially as no other references are made. One of these is labelled by Thunberg "*europæus*." It also perfectly agrees with the diagnoses under that name in Syst. Nat. ed. x. and xii., and in Mus. Ludov. Ulr. Reg. From this it appears almost certain that this specimen is a type of Linnæus's "*Scorpio europæus*"; and as it belongs to the species *Isometrus maculatus* (De Geer)*, this name should be changed to

Isometrus europæus (Linnæus).

This identification differs from the one proposed by Thorell, 1876 (Ann. & Mag. Nat. Hist. (4) xvii. p. 8) and 1877 (*l. c.* p. 168), and he, as well as Kræpelin (*l. c.*), uses the name given by De Geer. Both these authors put as the Linnæan synonym to De Geer's "*maculatus*" "*Scorpio americanus*" (Linn. Syst. Nat. ed. x.). This can, however, hardly be right, even if we leave the existing type specimen for *Scorpio europæus*, Linn., out of consideration, for "*Scorpio americanus*, Lin.," is said to be provided with "pectinibus 14-dentatis," but *Isometrus maculatus* (De Geer) has (16) 17-19 comb-teeth. De Geer makes the same mistake †, but quotes Syst. Nat. ed. xii. Linnæus's "*Scorpio europæus*" from Syst. Nat. is regarded by Kræpelin, and also previously by Thorell (*l. c.* pp. 163 and 165), as identical with De Geer's (*l. c.* p. 343, pl. xli.) "*Scorpio punctatus*" and

* For other synonyms see Kræpelin, "Revision der Skorpione: I. Die Fam. d. Androctonidæ," Jahrb. Hamb. wiss. Anst. viii. (Hamburg, 1891) p. 103.

† 'Histoire des Insectes,' t. vii.

"*europæus*," which he (Kræpelin) proves to be a *Phassus*, and therefore calls "*Phassus americanus* (L., 1754)," because Linnæus's "*Scorpio europæus*" in Syst. Nat. is supposed to be the same as that named "*S. americanus*"* in 1754 in 'Mus. Ad. Frid. Reg.' If, now, *Scorpio punctatus*, De Geer, is the species of *Phassus* which Kræpelin had in view, it should be called

Phassus punctatus (De Geer),

and the synonym "*Scorpio europæus*, Lin. 1758, 1764, 1767," must be changed to De Geer's "*Scorpio maculatus*," as already stated.

This *Isometrus europæus* (Lin.) [= *Ison. maculatus* (De Geer)] thus also receives, I regret to say, a name that is hardly suitable from a geographical point of view, but it cannot be helped. It is, however, in this case satisfactory that this nearly cosmopolitan species has been recently found in Europe, namely, at Huelva, in Southern Spain (see Kræpelin, l. c.), and it is the only *Isometrus* that has been discovered on the European continent.

The third Linnean scorpion in the Upsala Museum has been wrongly labelled "*americanus*" by Thunberg. It is, however, easy to identify it and to give it the name that rightly belongs to it, because there is only one of the diagnoses in Syst. Nat. that can be applied to it. It is evidently "*Scorpio australis*," "*pectinibus 32-dentatis, manibus lævibus*." According to Kræpelin's classification it is *Androctonus funestus*, Hempr. & Ehrenb.† Already, in 1876‡, Thorell had shown the probability of such an identification. It may be added, however, that since the specimen has the hands and fingers brown and the tail a little darker than the rest of the body, it resembles the form to which C. L. Koch gave the name *priamus* (see Pocock, Journ. Linn. Soc., Zool. xxv. pp. 305-307, 1895). By the existence of

* Kræpelin's quotation is, however, rather confused, as it reads:—"1754. *Scorpio americanus*, L., Mus. Ludov. Ulricæ, p. 429." The year 1754 is that of 'Mus. Ad. Frid. Reg.,' where this scorpion bears the name "*americanus*." But in 'Mus. Ludov. Ulricæ Reginæ,' on the page quoted, we find the name "*europæus*" for the scorpion with eighteen comb-teeth, and it was so written by Linnæus in 1758 (Syst. Nat. ed. x.).

† For other synonyms see Kræpelin, l. c. (1891) p. 33.

‡ Ann. & Mag. Nat. Hist. (4) vol. xvii. 1876, p. 7, footnote. He thinks it might be so because he, in the State Museum in Stockholm, had seen "a very old specimen" labelled "*Scorpio australis*, Linn.," and that was *Androctonus funestus*, Hempr. & Ehrenb.

this certainly Linnean specimen the identity of the species seems to be fully proved, and I do not hesitate to write

Androctonus australis (Linnæus).

= *A. priamus*, C. L. Koch.

In this case also the statement concerning the habitat is correct, as Linnæus writes "Habitat in Africa"; but even here he shows his uncertainty by adding "forte etiam America"!

The two Pedipalps dating from the time of Linnæus are both types from 'Mus. Ludov. Ulricæ Reginae,' namely "*Phalangium caudatum*" and "*Phalangium reniforme*."

The first of these is

Thelyphonus caudatus (Linnæus).

Because the habitat in this case is correctly given by Linnæus, the Linnean species has been allowed to retain its old name. The authors have fixed the name "*caudatus*" on the Javan form, which is right, as I have had the opportunity to confirm by an examination of the type specimen.

"*Phalangium reniforme*," on the contrary, has in 'Mus. Lud. Ulr. Reg.' p. 427, been referred to the New World, as Linnæus there writes "Habitat in America meridionali," and in Syst. Nat. ed. x. p. 619, we read "Habitat in America," to which in ed. xii. is added "Jamaica, Carolina." These notes on the habitat, together with the quotation by Linnæus in all three of the books mentioned—"Brown. Jam. 409, t. 41. f. 3"—has made later authors believe that "*Phalangium reniforme*" was a West-Indian form, which is easily explained. As Browne has figured a Tarantulid from Antigua, Pocock * believed himself justified in giving the Linnean name to specimens from that island. The Linnean type specimen, however, represents quite a different—an East-Indian—species of *Phrynichus*, auctorum. Under such circumstances four possibilities offer themselves:—(1) The type specimen from Mus. Lud. Ulr. Reg. might be regarded as justifying the application of the name "*reniforme*"; or (2) the figure in Browne's work might be adopted as the authority; or (3) it might be declared that the name "*reniforme*" should be abolished, as being a collective name; or (4) both the West- and East-Indian species might retain the name, as they belong to different genera and even subfamilies.

* Ann. & Mag. Nat. Hist. (6) vol. xiv. p. 297.

The subject might have been discussed at great length, but fortunately Linnæus himself already (1758) has decided in favour of the type specimen, as he, in putting the letters "M. L. U.," signifying "Museum Ludovicæ Ulricæ," after the diagnosis, refers to that specimen, although it was not described before 1764. Thus there can be no doubts in this case. In 1895, when publishing his 'Revision der Tarantuliden,' Kræpelin was informed by letters from Carl Aurivillius to which species "*Phalangium reniforme*" belonged. He was thus enabled to give the synonyms in that work as follows:—

Tarantula reniformis (Linnæus).

= *Tarantula lunata*, Fabr.

= *Phrynus ceylonicus*, C. L. Koch.

= *Phrynus scaber*, Gerv.

= *Phrynichus reniformis*, Karsch.

= *Phryniscus Deflersi*, Simon.

= *Phrynichus Jayakari*, Pocock.

According to Kræpelin* this species *Tarantula reniformis* (Linn.) embraces several forms to which, by different authors, have been given several different names. To judge from the descriptions and from the table given by Pocock, the Linnean specimen most closely agrees with "*Ph. Deflersi*," Simon.

As a curious fact, it might be mentioned that Thunberg retained the Linnean name on the label belonging to the 'Mus. Lud. Ulr. Reg.,' but to a specimen of the same kind belonging to his own "donatio" he gave the name "*lunatum*," while he named two specimens of *Neophrynus palmatus* (Herbst), * Kræpelin, *reniforme*. In this, I suppose, he was influenced by the descriptions given by Fabricius in his work 'Entomologia Systematica,' t. ii. pp. 432 and 433, where the name "*reniformis*" is used for a short-armed and "*lunata*" for a long-armed form.

XI.—*The Follicle-cells in Salpa*.

By MAYNARD M. METCALF †.

THROUGH the courtesy of Professor Brooks, of the Johns Hopkins University, I have been enabled to examine a number of finely preserved embryos of several species of *Salpa*, and I desire, after briefly referring to certain points in

* Abh. aus d. Geb. d. naturwiss. Bd. xiii. (Hamburg, 1895).

† From the 'Johns Hopkins University Circulars,' November 1897, pp. 3-5.

recent papers upon *Salpa* embryology, to describe such of the results of my study as bear upon the nature and rôle of the follicle-cells.

Since the publication fifteen years ago of Salensky's careful studies [see references at end of paper] interest in the development of this genus has centred more around the follicle-cells and their rôle than around any other point. Salensky showed that the young embryo was composed in part of a few true blastomeres derived from the fertilized egg, but more largely of a great mass of cells derived by proliferation from the follicle. He claimed that the true blastomeres early disappear, serving probably to nourish the inwandering follicle-cells, from which the adult organism is derived. That is, according to Salensky, the fertilized ovum serves merely as food for its unfertilized sisters (the follicle-cells), which are the really important elements.

He says (page 362):—"Aus den vorgeführten Stadien lässt sich der Schluss ziehen, dass die Blastomeren fortwährend an Zahl abnehmen, bis sie endlich ganz verschwinden. Diese Erscheinung kann auf zweierlei Weise erklärt werden. Entweder gehen die Blastomeren unter allmählicher Verkleinerung zu Grunde—sie könnten als Nährmaterial für die Bildungszellen dienen—oder sie verändern unter fortwährender Theilung Form und Bau und vermischen sich so mit den Gonoblasten, dass sie endlich von den letzteren nicht zu unterscheiden sind. Diese Frage durch direct Beobachtung entscheiden ist sehr schwer, und bei dem Material, das mir zu Gebote stand, war das unmöglich. Ich will deshalb hier nur Thatsachen vorführen, welche für und gegen diese beiden Voraussetzungen sprechen können. Erstens will ich bemerken, dass Form und Bau der Blastomeren so charakteristisch ist, dass sie mit den Gonoblasten schwer zu verwechseln sind. Selbst bei den kleinen Blastomeren, wie wir in Fig. 2 sehen, kann man nach dem Kern jedes Blastomer, wenn es auch nur von Gonoblastengrösse ist, ganz gut von den Gonoblasten unterscheiden. Der Blastomerkern ist rund, opak, färbt sich mit Carmin besser als der eines Gonoblasten, welcher letzterer eine ovale Form besitzt und ein kleines punktförmiges Kernkörperchen beherbergt. Zweitens will ich darauf aufmerksam machen, dass man in dem zuletzt betrachteten Stadium Blastomerenkerne antrifft, welche noch ihre Grösse behalten, aber deren Begrenzung nicht so scharf ist wie es in den Blastomeren der früheren Stadien der Fall ist. Sie verlieren also ihre scharfen Contouren, was schon darauf hinweist, dass diese Kerne in der That solchen Veränderungen unterliegen, welche ihr Absterben sehr wahrscheinlich

machen. Endlich gegen die Verwandlung der Blastomeren in Gonoblasten-ähnliche Zellen spricht auch der Umstand, dass man nie Übergangsformen antrifft, was doch der Fall sein müsste, wenn eine solche Verwandlung in der That existirte. Auf Grund aller dieser Thatsachen bin ich zur Überzeugung gelangt, dass die Blastomeren in der That allmählich schwinden, um die Hauptrolle bei der Entwicklung den Gonoblasten zu überlassen."

Todaro, in 1881, had described a peculiar fragmentation of the blastomeres, by which each broke up into numerous small nucleated cells. Salensky, referring to this point, describes the phenomena as follows (page 99) :—"Das Protoplasma derselben [of the blastomeres], welches in allen früheren Stadien feinkörnig, beinahe homogen war, zerfällt jetzt in kleine mannigfaltig gestaltete Parzellen, die theils um den Kern, theils in der Peripherie der Zellen gelagert sind. Als ich zum ersten Mal diesen eigenthümlichen Zerfall des Protoplasma beobachtete, glaubte ich es mit dem Product der Einwirkung der Conservations—oder Färbeflüssigkeit—zu thun zu haben. Derselbe kommt aber so beständig in gewissen Stadien der Entwicklung, namentlich nach dem ersten Forschungsstadium, vor, und erscheint von der Art des Conservirung so unabhängig, dass ich bald zur Überzeugung gelangte, dass diese Veränderungen des Protoplasma normale Entwicklungsvorgänge darstellen."

He speaks in another place (page 125) of "kleinen polyedrischen Protoplasmastückchen, in welchen ich trotz aller Mühe selbst an sehr schön gefärbten Präparaten, keinen Kern zu unterscheiden im Stande war. Ich muss deshalb die Zellennatur dieser Protoplasmastückchen vollständig in Abrede stellen."

From these quotations it is seen that he denies the cellular nature of the bodies within the blastomeres, but offers no explanation of their true nature.

More recent papers by Brooks, Heider, and Korotneff have dealt with the relations between blastomeres and follicle.

Brooks, in 1893, confirmed Salensky's description of the complex character of the young embryo, pointing out with the greatest clearness that the follicle-cells multiply very rapidly by *amitotic* division, the resulting cells pushing in among the blastomeres, which for a long time remain few in number.

He further showed that, as Salensky described, these migrated follicle-cells give rise to outlines or models of the organs. He, however, took issue with Salensky as to the ultimate fate of blastomeres and follicle, claiming and clearly

showing that in the later stages the follicle-cells composing the outlines of the organs are replaced by true blastomeres, which give rise to the adult. He says (page 27):—"Stated in a word, the most remarkable peculiarity of the *Salpa* embryo is this. It is blocked out in follicle-cells, which form layers and undergo foldings and other changes, which result in an outline or model of all the general features in the organization of the embryo. While this process is going on the development of the blastomeres is retarded, so that they are carried into their final positions in the embryo while still in a very rudimentary condition. Finally, when they have reached the places they are to occupy they undergo rapid multiplication and growth, and build up the tissues of the body directly, while the scaffolding of follicle-cells is torn down and used up as food for the true embryonic cells."

Brooks's figs. 1 and 2, plate xlii., also fig. 12, pl. ix., as well as his descriptions, demonstrate that the peculiar granular bodies seen within the blastomeres at certain stages of development are not an indication of the fragmentation or degeneration of the blastomeres, but are nuclei of follicle-cells that have been ingested and are undergoing digestion. This statement I have fully confirmed, as described a few pages beyond. The amitotic division of the migrating follicle-cells confirms the belief that they are on the road to degeneration, and in the centre of the embryo there are found masses of such disintegrating cells.

Heider's account of the embryology of *Salpa fusiformis*, published in 1895, differs in certain points from preceding accounts.

He interprets the granular bodies in the protoplasm of the blastomeres as ingested follicle-cells, and figures them as containing nuclei (pl. i. figs. 4, 10 a, 10 b), and largely from this observation argues, as Brooks had shown, that the follicle-cells serve as food for the blastomeres.

Heider places emphasis upon the unequal cleavage of the *Salpa* ovum, claiming, contrary to Salensky and Brooks, that, except in the early stages, the micromeres cannot be distinguished from the follicle-cells, and that organ rudiments, which are apparently formed from follicle-cells, are really composed of small blastomeres.

The insufficient reference in Heider's paper to Brooks's monograph may perhaps be explained by the fact that Heider's paper was practically complete before Brooks's work was published.

Korotneff's several papers are the most recent dealing with this subject. This author denies Heider's contention that

the smaller blastomeres are difficult to distinguish from follicle-cells, figuring and describing them as distinctly different, even in advanced embryos. On this point, then, Salensky, Brooks, and Korotneff agree in opposition to Heider.

As to the nature of the granular bodies in the protoplasm of the blastomeres, Korotneff says [Korotneff, iii. p. 342]:—
 “In meiner Schrift über die Embryologie von *S. democratica* habe ich mich gegen die Vermuthung von Heider, wonach diese Ablagerungen keine Dotterpartikelchen, sondern von den Blastomeren verzehrte Follikelzellen seien, ausgesprochen. Jetzt kann ich meine Meinung bekräftigen und ganz positiv behaupten, dass in den als Dotterplättchen bezeichneten Gebilden niemals eine Spur von Kernen zu sehen ist”—
 which is certainly true, at least for *S. hexagona* and *S. pinnata*, since these granular bodies are not ingested cells, but ingested follicle nuclei, as Brooks had shown, and as is evident in the material I have worked upon. The needle-like bodies figured by Korotneff in the protoplasm of the blastomeres of *S. cordiformis-zonaria* I have not seen described before. They appear from his figures to be peculiarly arranged chromatin particles within the ingested follicle nuclei. (Compare Korotneff, iii. plate xiii. fig. 14.)

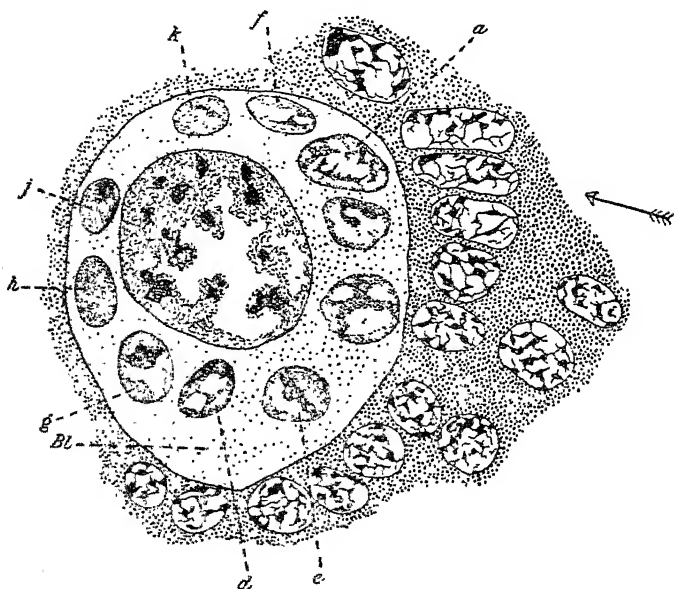
Korotneff fully confirms Brooks's description (without, however, mentioning Brooks) of the disintegration of the follicle-cells in the central region of the embryo, speaking of a retrogressive metamorphosis of the kalymmocytes, “welche ganz blass werden, sich schlecht färben, und zuletzt nur noch in Spuren zu erkennen sind. Kurz und gut, die Kalymmocyten gehen ganz zu Grunde, und ihre Bruchstücke dienen gewiss den Histogenen [blastomeres] als Nährmaterial” [by osmosis]. (Korotneff, iii. p. 335.)

Korotneff denies Brooks's statement that the organs are blocked out in follicle-cells, which later are replaced by blastomeres, saying that the organ rudiments are from the first composed of blastomeres. If he is not contending over definitions his statements on this point are difficult to understand, for his figures show with the greatest clearness just the condition of affairs Brooks has described. [Compare Korotneff, iv. Taf. xviii. fig. 5 (rudiment of cloaca composed of follicle-cells alone), figs. 6, 7, and 8 (rudimentary walls of amniotic cavity composed wholly of follicle-cells), fig. 9 (pharynx rudiments composed chiefly of follicle-cells) &c.]

I wish now to call particular attention to my own observations upon the nature of the disputed bodies within the protoplasm of the blastomeres of *Salpa*.

After having examined several hundred blastomeres, all showing the intra-protoplasmic bodies under discussion, I have selected a single blastomere to figure and describe, not because there are not many others showing a similar condition, but because this seems sufficient to establish the point.

The blastomere figured is one of five appearing in a section of an embryo of *S. hexagona* at that stage of development when the follicular epithelium of one half the surface of the embryo is most rapidly proliferating—about the stage shown in Brooks's fig. 2, pl. xi. The arrow indicates the direction of movement of the follicle-cells as they wander into the



Portion of a section of a young embryo of *Salpa hexagona*, showing one blastomere and fifteen migrated follicle-cells.

Bl=blastomere: *N*=nucleus of blastomere: *a, b, c, d, e, f, g, h, j, k*=nuclei of follicle-cells ingested by the blastomere.

centre of the embryo, where, as described by Brooks, many of them degenerate. The figure is carefully drawn with a Leitz $\frac{1}{2}$ immersion objective and a number 8 compensating ocular.

The large blastomere, *Bl*, has a very large nucleus, *N*, and evenly granular protoplasm, which does not stain deeply with

hæmatoxylin, borax-carmin, or saffranin. Outside the blastomere is a mass of more coarsely granular and deeply staining protoplasm, in which no cell-walls can be discovered, but in which appear many nuclei, all exactly resembling the nuclei of the follicular epithelium. These have a definite chromatic reticulum with rather small nodal swellings and no nucleolus.

Within the protoplasm of the blastomere as shown in this one section are seven bodies similar in size to the follicle nuclei just described, but quite different in appearance. I believe them to be ingested follicle nuclei. They do not stain so deeply as the nuclei outside, though they are much darker than the protoplasm of the blastomeres in which they lie. We do not find in them the clear cut chromatin reticulum with sharp contours, such as we see in the follicle nuclei, but in certain of them we do find what appears to be such a chromatic reticulum degenerating because undergoing digestion. Observe especially the nucleus *a*. The reticulum is evident, and I think no one can doubt that the body is really a nucleus. Compared with the follicular nuclei the reticulum is seen to stain less deeply and the fibrils and nodal masses do not have sharp contours. The whole appearance indicates the beginning of disintegration. I believe this nucleus to have been ingested but a short time previous to the killing of the embryo. At *b* and *c* are nuclei which have gone further in the process of degeneration, the chromatin threads being more diffuse. At *d*, *e*, *f*, and *g* we see a further stage in the same process, and at *h*, *j*, and *k* we observe within the ingested nuclei an almost evenly granular mass of disintegrating chromosomes. In other blastomeres and in another section of this same blastomere one can observe the last step in the degeneration, a mere mass of debris no longer delimited by a nuclear membrane from the surrounding protoplasm of the blastomere.

Notice that the less degenerated of these ingested nuclei lie on the side nearer the periphery of the embryo. The inwandering follicle-cells, as they push toward the centre of the embryo, penetrate the blastomeres that lie in their path. Apparently the most recently ingested nuclei, entering from the peripheral side, crowd the partly digested ones toward the inner side of the blastomere, giving the appearance figured. Not every section of a blastomere shows such diagrammatic arrangement, but this condition is noticeably frequent. The section figured was chosen because of the diagrammatic way in which it shows this point and because of the clearly nuclear nature of the body *a*.

As before mentioned, Brooks has given exactly this interpretation of the bodies within the blastomeres, and this confirmatory note would be uncalled for except for Heider's and Korotneff's more recent papers giving a different interpretation. It is possible that in *S. runcinata-fusiformis* (the species Heider studied) not only the follicle nuclei but also their cytoplasm may be ingested by the blastomeres; but I am more inclined to believe Heider was mistaken when he figured these bodies as nucleated cells. His figures are not drawn with careful attention to detail, so it is hard to judge from them. In *S. pinnata* and *S. hexagona* no cell-walls can be made out in the mass of migrated follicle-cells. It is therefore by no means probable that the cytoplasm of the follicle-cells could be seen if it were ingested with the nuclei. This is especially true in view of the digestive action upon these bodies within the blastomeres.

Korotneff's and Salensky's statements that these bodies contain no trace of a nucleus within them is, of course, true if they be themselves nuclei.

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The Biological Laboratory of the
Woman's College of Baltimore.
May 13th, 1897.

XII.—Description of Two new Species of Oriental Cicadidæ.
By W. L. DISTANT.*Platyleura bouruensis*, sp. n.

Body greenish ochraceous. Head with a central spot on the upper margin of face, area of ocelli connected by two narrow fasciæ to eyes and by three linear fasciæ to base, black. Pronotum with a narrow central linear fascia and two similar oblique fasciæ on each lateral area, black. Mesonotum with a central lanceolate fascia broadest posteriorly, two broken obconical spots on anterior margin, followed on each side by a somewhat triangulated fascia, and a small rounded spot at anterior angles of cruciform elevation, black. Abdomen above with basal abdominal fasciæ and anal appendage black.

Tegmina opaque, creamy ochraceous, mottled with pale fuscous spots, which irregularly and obscurely form three transverse fasciæ—first crossing radial area, second traversing the ulnar and third the apical areas.

Wings very dark chocolate-brown, with an ochraceous spot on costal area, a similarly coloured but larger and angulated spot on abdominal area, and a small obscure spot near apex; costal margin and a spot on posterior margin creamy white.

Long. excl. tegm. ♀ 20 millim.; exp. tegm. 66 millim.

Hab. Malay Archipelago, Bouru (*Fruhstorfer*).

This species is allied to *P. Kämpferi*, Fabr., which is not uncommon in China and Japan.

Prasia culta, sp. n.

Head and eyes chocolate-brown. Pronotum ochraceous, with two central, narrow, longitudinal, linear fasciæ, the posterior margin and lateral angles, chocolate-brown. Mesonotum ochraceous, with six pale obconical spots on anterior margin. Abdomen above pale chocolate-brown, with the posterior abdominal margins narrowly reddish. Sternum and legs pale ochraceous, anterior tibiæ brownish, abdomen beneath paler than above.

Tegmina and wings pale hyaline, their extreme bases vermilion-red; costal membrane chocolate-brown, venation brownish ochraceous; basal cell of tegmina infuscated.

Rostrum reaching the anterior coxæ.

Long. excl. tegm. 22 millim., exp. tegm. 65 millim.

Hab. Malay Archipelago, S. Celebes, Patunuang (*Fruhstorfer*).

XIII.—Description of a new Species of *Calosoma* (*Coleoptera*, *Geodephaga*). By CHAS. O. WATERHOUSE, F.E.S.

HAVING had occasion to examine the genus *Calosoma* from a geographical point of view, I was surprised not to find the following Australian species described. It is of interest as approaching in its general appearance the species from New Caledonia—*Calosoma oceanicum*. I propose to call it *C. Walkeri*.

Calosoma Walkeri, sp. n.

Statura *C. sycophantæ*, minus convexum, thorace angustiori. Nigrum, nitidum; thoracis marginibus viridi tinctis; elytris brunneocupreis, punctato-striatis, interstitiis parum convexis, sublavibus, marginibus anguste viridibus; corpore subtus viridi-tincto; pedibus obscure piceis. ♀.

Long. 13, lat. $6\frac{3}{4}$ lin.

Hab. W. Australia, Swan River (*Macgillivray*); Roebuck Bay (*J. J. Walker*).

In general form this species resembles *C. sycophanta*, but the thorax is relatively rather narrower and the elytra are much flatter. The head is smoother, with a little green near the eyes. The thorax has the same form, but perhaps the sides are a little less sinuate posteriorly; the surface is smoother, the disk black, the rest of the surface tinted with copper, the extreme margins green. The elytra are brownish coppery, with a little green near the scutellum and on the margins; they are punctate-striate, but the striæ are only lightly impressed, and consequently the interstices are only gently convex. The usual punctures on the fourth, eighth, and twelfth interstices are very small and are only visible in some lights near the apex. The underside of the body is pitchy, with bright green reflections.

As the species of this genus are extremely difficult to determine, it may be useful to note that the type specimens of the following species are in our Natural History Museum:—

- Calosoma ampliator*, Bates. Cent. Amer.
- *lave*, var. *punctulicolle*, Bates. Cent. Amer.
- —, var. *explanaticolle*, Bates. Cent. Amer.
- —, var. *microgonum*, Bates. Cent. Amer.
- *omitemium*, Bates. Cent. Amer.
- *diminutum*, Bates. Cent. Amer.
- *morelianum*, Bates. Cent. Amer.
- *porosifrons*, Bates. Cent. Amer.
- *galapagerum*, Hope. Galapagos Is.

- Calosoma irregulare*, Walker. Vancouver.
- *laterale*, Kirby. Brazil.
- *retusus*, Fabr.* Patagonia.
- *patagoniense*, Hope. Patagonia.
- *tegulatum*, Woll. Cape Verde Is.
- *curvipes*, Kirby. Brazil.
- *helene*, Hope. St. Helena.
- *haligena*, Woll. St. Helena.
- *chinense*, Hope. China.
- *madera*, Fabr. Madeira.
- *frigidum*, Kirby. N. Amer.

XIV.—Puliciphora, a new Flea-like Genus of Diptera.

By FRIEDRICH DAHL, of Kiel †.

At last we appear to be obtaining a clue to the origin of the flea: in sorting out my wholesale captures from the Bismarck Archipelago I found a Phorid which, owing to the total loss of wings and halteres, had acquired a great similarity to a flea—a similarity that appears to be by no means confined to purely external and adventitious characters. Since we are still completely in the dark concerning the question with what other family of insects the Pulicidæ are most closely allied—there has even been a dispute as to the order to which they are to be assigned—all data of this sort must be of interest.

For the form before me I establish a new genus, and since it is intermediate between the Phoridæ and Pulicidæ, I term it *Puliciphora*. I designate the species *lucifera*, since it appears for the first time to bring light to bear upon a dark matter. The genus has decided affinity to the Phoridæ, and I unhesitatingly assign it to this family. The antennæ, mouth-parts, legs, and female genital organs all agree perfectly in type with the corresponding organs of the members of the family in question. The genus, however, is distinguished from almost all other known genera of the family by the entire absence of wings and halteres, by the unusually great reduction of the thorax, and by the eyes being greatly reduced in size. The thorax, which in the winged genera of Phoridæ is much longer and thicker than the head, is here much smaller than the latter, a sign that the

* This, I think, is certainly not the species known to me as *alternans*, F., with which it is placed in Gemminger's Catalogue. The sixth interstice of the elytra is a little narrower than the fifth and seventh, which are nearly smooth.

† Translated by E. E. Austen from the 'Zoologischer Anzeiger,' Bd. xx. No. 543 (October 21, 1897), pp. 409-412.

muscles of flight must also be absent or rudimentary. The eyes, which in the case of *Phora* (when the head is regarded from the side) occupy nearly half of the cephalic surface, here cover barely a third of it in the case of the female, and in the male are still further reduced. The male genital organs also show divergence; they protrude to a far less extent. As in *Phora*, the dorsal side of the abdomen is overlaid with shining dark-coloured chitinous plates, corresponding with the number of the segments. The female possesses five and the male six of these dorsal plates, besides which the male has a similar plate on the ventral side in front of the genital organs.

The only wingless genus of Phoridae hitherto described is *Ænigmatias*, of Meinert (Entomol. Meddelelser, Bd. ii. p. 212, 1890). In bodily form this genus differs from *Puliciphora* just as greatly as from the winged Phoridae. The body is like that of a cockroach in shape, without incisions between head, thorax, and abdomen, and the thoracic rings, which, when viewed from above, are indistinguishable from the abdominal ones, are broader than the head. In *Puliciphora*, just as in the winged Phoridae, the narrower thorax is separated from the head and abdomen by deep incisions. The arista, too, which in *Ænigmatias* is bare, is here, as in *Phora*, pubescent. The first joint of the tarsus of the hind legs is, as in *Phora*, provided with a brush consisting of several rows of setae. While *Ænigmatias*, which is an inquiline form found in ants' nests, appears to constitute a transition towards the bee-parasite *Braula*, and has nothing in common with the Pulicidae, *Puliciphora* itself exhibits distinct affinity to the fleas.

In colour *Puliciphora lucifera* is brownish yellow, on the upper side almost blackish brown. The size of the female varies between $\frac{3}{4}$ and $1\frac{1}{4}$ millim.; the male is smaller and only about $\frac{2}{3}$ millim. in length.

On showing the new form to Privy Councillor Möbius, this gentleman drew my attention to the fact that a similar insect had been discovered in Africa by Mr. Cook, of Washington, U.S.A.; Herr Möbius informed me that the affinities of the insect in question had still to be elucidated by Dr. Wandolleck; all that was certain was that it must belong to the Diptera. We thereupon compared the two forms: they proved to be closely allied, but must nevertheless be assigned to different genera.

Now, since I was not only myself the discoverer of the form before me, but also recognized with certainty its affinity to the Phoridae—a thing which, as he himself told me, would

have been difficult, if not impossible, for Dr. Wandolleck to do in the case of the other still more aberrant species—I consider that I am justified in being the first to introduce this interesting series of forms to science, especially as I have been engaged for a long time past in collecting material for a monograph on the Phoridae. Since, however, the anatomical investigation of the allied form was already commenced some weeks ago by Dr. Wandolleck, I am in addition handing over to him adequate material for a similar purpose. From him therefore we shall have to expect in the near future further interesting results dealing with this group of forms.

In the present paper I would merely add a few observations on the ethology of the species discovered by me. I found the insect in numbers in my wholesale captures (“quantitativen Fängen”) which I made in the Bismarck Archipelago, and particularly in the forest, with a dead bird as bait. For obtaining creatures of this kind I can therefore recommend my method of capture, which I have described in detail in the ‘*Berichten der Academie der Wissenschaften in Berlin*,’ Jahrg. 1896, ii. p. 17. At first on examining it with the naked eye I took the insect to be a *Sminthurus* (Poduridae). With us representatives of this genus are frequently found among captures made upon carrion, but in the Bismarck Archipelago they appear to be absent. I allude to the outward resemblance merely in order to facilitate their possible discovery. Subsequently under the microscope I actually considered the first specimen to be a *Phora* which had lost its wings, so great is the resemblance to that genus. I may add that I found a few specimens besides other carrion-insects upon the flower of *Amorphophallus*, an Aroideid, which has an unpleasant carrion-like odour and grows almost upon the ground. The insect is therefore decidedly a carrion-feeder, like the rest of the Phoridae.

PROCEEDINGS OF LEARNED SOCIETIES.

GEOLOGICAL SOCIETY.

June 23rd, 1897.—Dr. Henry Hicks, F.R.S.,
President, in the Chair.

The following communication was read:—

‘Pleistocene Plants from Casewick, Shacklewell, and Grays.’
By Clement Reid, Esq., F.L.S., F.G.S.

The plants from Casewick and Shacklewell were obtained by washing two lumps of clay in the collection of the late Sir Joseph

Prestwich. The species are few and call for little remark, except that the climate was not Arctic. They are all common British forms.

The collection from Grays consists of leaves, already partly determined by Gaudin and Herr, though unpublished, and some lumps of clay, out of which the Author washed a few seeds. The flora points clearly to a temperate climate and mild winters.

MISCELLANEOUS.

"*Mesites*."

THE name *Mesites* has been used in systematic zoology for no less than four different genera, belonging to different classes of animals, as anyone may learn for himself from Scudder's 'Nomenclator Zoologicus.' "Thus bad begins, but worse remains behind"; for three of these names are actually current. To one man *Mesites* conveys the idea of a bird, for another it means a weevil, while some of us have long known by that name nothing but a peculiar paleozoic echinoderm. Which is the real Simon Pure?

In vol. iv. part 2 of C. J. Schönherr's 'Genera et Species Curculionidum,' on p. 1043, *Mesites* was proposed for a genus of weevils, type *M. pallidipennis*, by C. H. Boheman. This volume was published at Paris by Roret and at Leipzig by Fleischer, and the date on the titlepage of the part is 1838. An advertisement of Roret's on the back of the half-title indicates that the book was issued in January of that year; the date, 1 Febr. 1838, attached to the preface of vol. v. confirms this.

But in April 1838 Isid. Geoffroy St.-Hilaire applied the same name to a kind of sun-bittern from Madagascar (*M. variegata*). The chief references are:—Comptes Rendus, vi. p. 443, April 9; Revue Zoologique, 1838, April, p. 50; and Ann. Sci. Nat. ix. p. 189. In the 'Catalogue of Birds in the British Museum,' vol. xxiii. p. 244, 1894, Dr. Bowdler Sharpe maintained this name, and even based on it a family name, Mesitidæ, as had already been done, though in a somewhat different sense, by C. L. Bonaparte. Boheman's priority to Geoffroy might conceivably be disputed by a prejudiced ornithologist, could such a one be found, were it not for the evidence of Reichenbach, who, on p. 6 of his 'Handbuch der Columbariæ,' 1850, altered the name of the bird to *Mesenas*, since "Der Name *Mesites* war um ein Jahr früher durch Schönherr schon an eine Rüsselkäfergattung vergeben." It was probably for the same reason that Bonaparte, according to Gray ('Hand-list Gen. and Sp. Birds Brit. Mus.' p. 267, 1869), changed *Mesites* to *Mesitornis* in 1855; but whether this was ever more than a MS. name is uncertain, since no reference can be found, and its alleged author still used *Mesites* on May 12, 1856 ('Comptes Rendus,' xlii. p. 876).

In April 1842 L. Jenyns ('Zoology, Voyage of H.M.S. 'Beagle,' part iv. Fish, p. 118) applied the name *Mesites* to three new species

of freshwater fish. In this case no difficulty arises, since the date was unquestionably later and since the species are recognized as falling under the *Galaxias* of Cuvier, 1817.

The fourth, I will not venture to say the final, use of the name was by E. Hoffmann in his paper "*Mesites*, eine neue Gattung der Crinoideen" (Verhandl. Russ.-kais. mineral. Gesell. St. Petersburg, 2^e Ser. Bd. i. pp. 1-5, pl. i., 1866), the only species being *M. Pusirefskii*. The genus is not a crinoid in the modern restricted sense, but is usually regarded as a cystid, having affinities with the Echinoidea, or the Edrioasterida, or the Blastoidea, according to the taste of the person discussing it. The name *μεσίτης* (a mediator) is therefore appropriate enough; but it belongs to the weevil, and another name must be found for the echinoderm. None exists already; even Professor Hæckel, in his recent ingenious rearrangement and renaming of the Cystidea, did not lay hands on *Mesites*. Having occasion to refer to this genus in more than one forthcoming publication, I propose to do so under the name *Mesocystis*.

This bibliographic inquiry has been facilitated by the kindly help of my colleagues, R. Bowdler Sharpe, W. R. Ogilvie Grant, C. O. Waterhouse, and C. J. Gahan, who, so far as their respective subjects are concerned, agree with the following conclusions. The four *Mesites* must be spoken of in future thus:—

- the weevil as *Mesites*, Boheman in Schönherr, 1838;
- the bird as *Mesornas*, nom. mut., Reichenbach, 1850;
- the fish as *Galaxias*, Cuvier, 1817;
- the echinoderm as *Mesocystis*, nom. nov.

F. A. BATHER.

British Museum (Natural History),
Nov. 30, 1897.

Observations on the Crabs of the Family Dorippidæ.

By E.-L. BOUVIER.

The Dorippidæ are crabs which for the most part live at a greater or less depth in the ocean. Prior to the submarine explorations effected during the last twenty years they were divided into three genera (*Dorippe*, *Ethusa*, *Palicus*), and numbered no more than thirteen species; since then the number of species has progressively increased until it now amounts to sixty, which are distributed among nine genera. Having had most of these forms at my disposal, I thought it would be advantageous to make use of them in order to determine the origin and evolution of the family.

If the Dromidæ occupy the front rank among the crabs and connect the latter with the Macrura belonging to the lobster-group, the Dorippidæ follow immediately after and must be considered as modified Dromidæ. This fact is to-day admitted without dispute by the greater number of zoologists; but it is all that is known as to the origin of the family, and hitherto no one has fixed

more precisely its true point of departure. Now the Dromidæ include three very distinct subfamilies (Homolinæ, Drominæ, Dynomeninæ), and we are entitled to ask ourselves which of these is the one whence the Dorippidæ have sprung.

The question is not difficult to solve. Almost all the Dorippidæ exhibit a lateral line, and in many of them the females are provided with peculiar furrows on the sternal face of the thorax. These two fundamental characters reappear in the Drominæ and in the Dynomeninæ, and since they are absent in the case of the Homolinæ, this latter subfamily is *de facto* set on one side. Again, many Dorippidæ have a rostrum which is decidedly triangular in shape, like that of the Dynomeninæ; moreover, the Palicids, their most primitive group, resemble the latter subfamily in respect of the posterior pair of legs, which alone are modified and brought over on to the back. The Dorippidæ therefore are connected with the Dromidæ of the subfamily Dynomeninæ.

The adaptive modifications which have transformed the Dromidæ into Dorippidæ have essentially affected the respiratory organs. The efferent apparatus has developed in a fairly progressive manner: the two expiratory orifices, which are very wide apart in the Dromidæ, have gradually approached one another, and have ended by fusing together into a more or less projecting endostomial furrow on the frontal side. But it has been otherwise in the case of the afferent orifices. Situated at the very base of the anterior limbs in the Dromidæ, sometimes they have undergone reduction until they closed altogether, sometimes they have become enlarged and elongated and have assumed the form of a cleft, in which moves the basal joint of the external maxillipeds, with its long epipodite. Hence two subfamilies, two separate series, which also differ one from another in other important characters.

Among these latter the most typical are those which are connected with the female genital apparatus. In the species belonging to the first series the female sexual aperture has remained at the base of the third pair of limbs, as in the case of the Dromidæ; moreover, the eggs are few in number, of very large size, and certainly produce young differing but little from the adult. In the second series the female sexual aperture has become sternal in position, as in the case of the crabs, while at the same time the eggs, which are numerous and small, produce but little advanced larval forms. I do not see what relation exists between these two classes of characters; but, as regards the position of the sexual apertures, it is permissible to state that the Dorippidæ of the first group are far from having completed their evolution, for the Leucosidæ, which show great affinity to them, already exhibit these orifices on the sternal face.

As for the special evolution of the two subfamilies, this appears to me to be closely connected with the dimensions of the ova. With large eggs, and consequently late hatching, the young are necessarily little different from the adult and badly endowed as regards swimming-power; the dissemination and, in consequence, the diversification of the forms must be limited. With small eggs

and the precocious hatching which results therefrom the young are swimming larvæ well suited to disseminate the forms and to cause them to vary. In fact, the Dorippidæ of the first series are much less numerous than those of the second: of the former ten species are known, as against fifty belonging to the second group.

Like the primitive Dynomeninæ (*Acanthodromia*, *Dynomene ursula*—a near ally of *D. Filholi*), the Dorippidæ originated in the Caribbean Sea and in the neighbouring parts of the Pacific at an epoch when the Isthmus of Panama had not yet emerged from the bottom of the waters. The Caribbean Sea, in fact, numbers not less than five-and-twenty species, belonging to all the genera except *Cymonomops* and *Dorippe*, which are those in which, in each subfamily, evolution has assumed its greatest intensity. Nay, more, it is the primitive forms that abound in the Caribbean Sea (fifteen species of *Palicus* out of twenty-two, all the known species of the genera *Cymopolus* and *Corycodus*), while the ultimate forms prevail in the centres remote from this sea (ten out of twelve species of *Dorippe* in the western Indo-Pacific area, *Cymonomops*). It is to be observed that several species belonging to the Caribbean Sea are found again in the eastern Atlantic, or are represented by very closely allied forms in the American waters of the Pacific. These facts, in conjunction with many others of the same nature, allow us to conclude that at an epoch but little removed from our own the Strait of Panama still existed, and that the relations between the two shores of the Atlantic were much closer than they are to-day *. —*Comptes Rendus*, t. cxxv. no. 20 (November 15, 1897), pp. 784-787.

“*Butterflies from the Pacific Islands.*”

To the Editors of the ‘*Annals and Magazine of Natural History.*’

GENTLEMEN,—I venture to direct your attention to the very inaccurate title given by Mr. Grose-Smith to his paper on new butterflies in the last number of your Journal (ser. 6, vol. xx. p. 515). Of the six species there described, the first is from Sumba Island, one of the Timor group, the next four from New Guinea, and the last from one of the Solomon Islands. To call this a paper on “New Species of Butterflies from the Pacific Islands” seems to me a serious geographical error.

I am, Gentlemen,

Yours &c.,

P. L. SCLATER.

3 Hanover Square, W.
Dec. 2nd, 1897.

* The two subfamilies of which I have spoken above are the *Cyclodorippinæ* and the *Dorippinæ*. In a subsequent paper I shall show that the former divides itself naturally into two tribes—CYMONOMI (*Cymopolus*, *Cymonomus*) and CYCLODORIPPI (*Corycodus*, *Cyclodorippe*, *Cymonomops*); the latter into two others—PALICI (*Palicus*) and DORIPPI (*Ethusa*, *Ethusina*, *Dorippe*).

Note on Thomas Martyn's 'Psyche,' 1797.

By C. DAVIES SHEERBORN, F.Z.S.

The impression of Martyn's 'Psyche, or figures of nondescript Lepidopterous Insects or rare Moths and Butterflies from different parts of the World,' London, 1797, folio, was limited to ten copies. There is a note to this effect in the Banksian copy initialed by H. H. B., and the statement also occurs in Lowndes and other writers.

The book consists of a line-engraved titlepage, followed by thirty-two copper-plates, very faintly engraved in stipple—perhaps a mere guide to the colourist, as may be seen in Mr. Salvin's copy. The first four plates have numbers very faintly stippled in the top left corner, the remainder are unnumbered.

Three examples of text are known to me, all consisting of sign. B, "Advice," pp. 1-4; sign. B, "Avis," pp. 1-4; sign. C, pp. 5 and 6,—sign. C, pp. 5 and 6, being descriptions of *Papilio amulius*, *Papilio myrina* (p. 5), and *Papilio sessonia* (p. 6) in English and in French: that is to say, altogether 6 pp. in English and 6 pp. in French, descriptive of pls. 1 and 2. The remainder of the plates have in the four copies I have seen, and which are probably in the original bindings, the names and localities of the insects written in ink on the plates themselves or on the interleaving fly-sheets.

I regard this book as a manuscript, for, with the exception of three species, the rest are apparently all manuscript names; but as the book seems to be quoted by Lepidopterologists, I have in my 'Index Animalium' referred to the species in square brackets as MS. for their convenience.

Here follows a collation of the various copies I have seen or about which I have been able to obtain information:—

1. British Museum. George III.'s copy (37 f. 13).—On large paper. Title, no text, 32 plates. Names on fly-leaves.
2. British Museum (444 f. 7). Said to be Sir J. Banks's copy. Was the Towneley copy referred to in Lowndes's 'Bibliographer's Manual' as having been sold for £1 1s., and still has the well-known Ex Libris of John Towneley Esq.—Title, no text, pls. 1-28, 30-32; pl. 29 is missing and pl. 32 is smeared and partly ruined.
3. Radcliffe Library, Oxford.—Title, no text, 32 pls. Names on the fly-leaves.
4. Osbert Salvin's copy.—On vellum, with a $\frac{1}{16}$ -inch gold line tooled round each plate. Title, no text, 32 pls. Pls. 5, 15, 20, and 22 supplied in *facsimile* from the Janson copy. Names at the bottom of each plate. The interest of this magnificent copy lies in the fact that an additional figure (unnamed) occurs on pl. 24, not seen in any other.
5. Van de Poll's copy, formerly E. W. Janson's.—Title, no text, 32 pls. Names in ink on the fly-sheets. [From information by memory of those who have seen it; neither Mr. Van de Poll nor Mr. Janson has responded to my letters.]

6. British Museum (Natural History), Zoological Library.—Copy of no. 1 with original wrapper, deckle edges. Title, English text 6 pp., French text 6 pp., pls. i. and ii. [This is the original copy presented by Martyn to the British Museum in 1797, and still has the following letter accompanying it:—

“To the Noblemen and Gentlemen

“Trustees of the British Museum.

“Mr. Martyn takes the liberty of Offering his best respects to the Noblemen and Gentlemen Trustees of the British Museum; And previous to the Publication, Requesting they will do him the honor to accept the First Number of his Work ‘On Nondescript Lepidopterous Insects,’ to be deposited in the British Museum Library. The remaining Sixteen Numbers, (which will Form the First Volume) will also be presented in Succession, as they are completed.

“No. 12 Great Marlborough

Street Oct. 24th 1797.”]

7. Royal Society.—“Ex dono auctoris Nov. 9, 1797.” Title, text 6 pp. English, 6 pp. French, 2 plates. This copy has been chopped down to fit a volume of other tracts.
8. Linnean Society.—A copy identical in every respect with that of the Royal Society, including the chopping down; but the title has been turned up at the bottom, and so preserved.
9. Dr. A. G. Butler’s copy.—Sold to Dulau and Co. in 1888, not traced since. Dr. Butler kindly informs me that he is under the impression that he had three parts in their original condition.
10. “Parts 1 and 2 with printed text.”—Dr. Butler is also under the impression that Mr. Van de Poll has copies of these two parts, but I am unable to verify the statement.

Of the above copies I consider George III.’s as the most perfect, the Radcliffe next, then Van de Poll’s, and, lastly, Mr. Salvin’s.

It would be interesting to learn whether Martyn ever did present to the British Museum the succeeding parts; I am inclined to think he did not, because this copy, as well as those in the Royal and Linnean Societies, may be well regarded as “specimens” of which it is quite likely others may turn up.

It is interesting to trace the Towneley copy, and it shows the importance of not tearing out marks of possession for the collector’s scrap-book.

I should be very glad to hear from anyone who knows of more than 6 pp. of text, especially if he will send me a list of species described, with their pages; and as it may be a matter of convenience to many entomologists, I here append a list of the manuscript names used by Martyn, together with his plate and figure numbers:—

I. *P. amulius* (1), *P. myrina* (2 and 3).

II. *P. amulius* (4), *P. sessonia* (5 and 6).

- III. *P. cresphontinus* (7), *P. daphnis* (8).
- IV. *P. cresphontinus* (9), *P. daphnis* (10).
- V. *Ph. orontes* (11), *Ph. (B.) purpurina* (12 and 13).
- VI. *Ph. orontes* (14), *Ph. (N.) nymphagoga* (15 and 16).
- VII. *Ph. (Atlas) polyphemus* (17).
- VIII. *Ph. (Atlas) polyphemus* (18).
- IX. *Ph. (Geom.) cineraria* (19), var. (20); *Ph. (N.) cuprea* (21).
- X. *P. galanthus* (22, 23).
- XI. *Ph. (Geom.) cineraria* (24), *Ph. (B.) coelebs* (25), *Ph. (N.) cuprea* (26).
- XII. *P. pantheratus* (27), *P. delia* (28 and 29).
- XIII. *Ph. (G.) moriata* (30), *Ph. (Pyr.) cludialis* (31), *Ph. (N.) signifera* (32 and 33).
- XIV. *P. argenteus* (34), *P. pantheratus* (35).
- XV. *Ph. (B.) plantagina* (36 and 37), *Ph. (B.) menthustrina* (38), *Ph. (N.) argentomacularis* (39).
- XVI. *P. amphimedon* (40).
- XVII. *P. (N.) incisa* (41 and 42), *Papilio* [sic]; *Ph. (N.) puellina* (43 and 44).
- XVIII. *P. amphimedon* (45).
- XIX. *Sph. cana* (46), *Ph. (B.) clymene* (47 and 48).
- XX. *Ph. luteolante* (50 and 51), *Sph. instibilis* (49), *Ph. (B.) limacina* (52).
- XXI. *Sph. instibilis* (53), *Ph. (N.) bilinearis* (54 and 55), *Ph. (N.) chrysitina* (56).
- XXII. *Ph. (B.) caja* (57), *Sph. omothberina* (58 and 59), *Ph. (N.) tulipina* (60).
- XXIII. *P. macularia* (61 and 62).
- XXIV. *Ph. (B.) caja* (63), *Ph. (N.) vermicularis* (64 and 65).
- XXV. *Sph. clorinda* (66 and 67).
- XXVI. *Sph. sanguinosa* (68 and 69), *Ph. (B.) corylina* (70), *Ph. (B.) pudarina* (71).
- XXVII. *Ph. (N.) lugubris* (72 and 73), *Ph. (N.) coriana* (75 and 76).
- XXVIII. *Ph. (B.) potatorina* (77), *Ph. (B.) defloriana* (78 and 79), *Ph. (Geom.) albolineata* (80).
- XXIX. *Sph. pinastrina* (81), *Sph. argentiflua* (82 and 83), *Ph. (N.) clathrea* (84).
- XXX. *Sph. pinastrina* (85), *Ph. (N.) interpressa* (86 and 87), *Ph. (B.) perspicellina* (88).
- XXXI. *Ph. (N.) pudarina* (89), *Ph. (B.) lubricipedina* (90 and 91), *Ph. (N.) olivia* (92).
- XXXII. *Ph. (N.) domicuca* (93), *Ph. (N.) incisa* (94), *Ph. (Tort.) argentana* (95 and 96).

Male and female are often figured; hence the duplication of specific names.

I am indebted to Mr. Salvin for the loan of his beautiful copy of this book, and to Prof. H. A. Miers for his kindness in sending me a complete account of the Radcliffe Library volume.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[SEVENTH SERIES.]

No. 2. FEBRUARY 1898.

XV.—*Some Activities of Polar Bodies.* By E. A. ANDREWS*.

THE acceptance of the view that the polar bodies given off by the eggs of animals are but imperfect eggs incapable of fertilization, and having no part to play in the development of the true egg, has naturally tended to lessen interest in their fate. That they often remain attached to the egg for a long time, and that in certain insects, according to Henking, they may remain within the egg or go back again into it, are facts that have seemed of no moment.

A recent paper† having shown that in certain Echinoderms the polar bodies as well as the egg are possessed of remarkable powers hitherto supposed to be limited to certain Protozoa, and that the polar bodies soon become, and may permanently remain, fused with the developing egg, makes it of great interest to inquire whether the polar bodies of other animals have such powers and such opportunities for possibly influencing the development of the egg.

It seems that in the star-fish and the sea-urchin the egg, both before and after fertilization, acts very like many filose Rhizopods—the protoplasm is seen to project itself out from

* From the 'Johns Hopkins University Circulars,' November 1897, pp. 14–16.

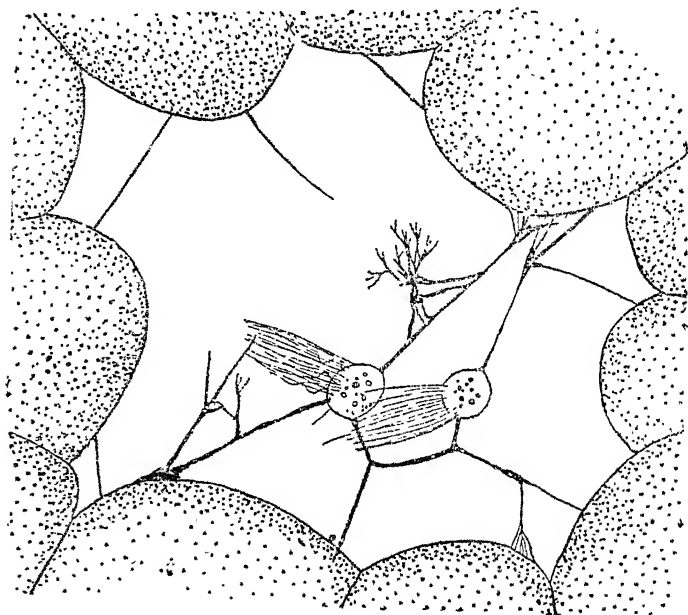
† G. F. Andrews, "Some Spinning Activities of Protoplasm," *Journal of Morphology*, xii., 1897.

the mass in the form of delicate flowing currents of living material that form filose pseudopodia. These thread-like processes have the power to unite with or separate from one another, to lengthen or to shorten, to become thick or thin, much as do the pseudopodia of *Gromia*. By means of such living material spun out from the cells all parts of the young organism are held together as one continuous mass of living matter, the continuity being established as fast as cell-division tends to interrupt it.

The polar bodies act like the cells of the cleaving egg, and from the first become organically continuous with the egg-cells by means of living threads spun out from the polar bodies and from the egg.

In figure 1 the polar bodies are represented lying over the relatively large opening that leads into the cleavage cavity of

Fig. 1.



the many-celled blastula. This figure is from a camera-lucida sketch made in 1894 with Zeiss ocular 8, objective 2 millim., and draw-tube 170 millim., by G. F. Andrews, from the living blastula of the *Asterias* common at Roscoff, France. Under this magnification of more than one thousand

diameters the polar bodies are plainly connected with each other and with the surrounding cells of the blastula by delicate threads of protoplasm that constantly change. There are also characteristic tufts or brushes of more delicate threads sent out from each polar body; these also constantly change.

It will be noticed that the cells about the orifice also show threads stretching from one to the other as well as to the polar bodies.

On the threads protoplasmic masses flow along to or from the polar bodies or from cell to cell, and on the threads side spinings may take place, producing such branching, root-like tufts, and anastomosing complexes as are partly represented in the figure.

The peculiar contractile powers of the material of these threads is illustrated in the figure in the case of a curved connective that joins the angle of one process to the angle of another. These processes extend from the two polar bodies to two separate cells on the margin of the orifice or cleavage-pore, and the curved connective seems as if tending to draw the processes closer together by bending itself (compare *loc. cit.* pp. 382-83).

Passing over many significant facts, we note that the polar bodies may pass through the cleavage-pore into the interior of the blastula and be connected with the complicated mass of threads joining the mesenchyme-cells with the ectoderm and entoderm in the gastrula-stage.

Thus in these animals the polar bodies long continue to act like Heliozoa, and acquire a living continuity with the embryo which may extend to the gastrula stage in such a way as to make them permanently part of the organism.

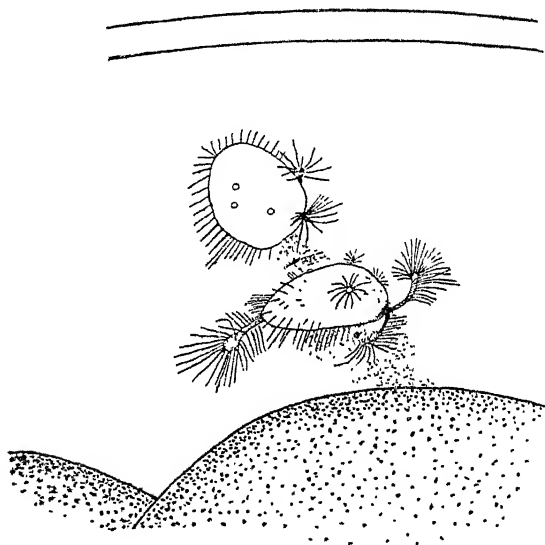
In the large Nemertean, *Cerebratulus lacteus*, Verrill, I find some spinning activities of the egg and its cells and most marked activity of the polar bodies. Soon after their formation the polar bodies send out delicate Heliozoa-like rays, and later characteristic star-like groups of processes that may develop into long proboscis-like outgrowths armed with lateral threads. From the first the polar bodies are continuous with the egg and with one another by means of an exceedingly delicate film of material that sometimes shows fine threads and nodules within it, and seems living protoplasm rather than passive excretion or "slime."

In figure 2 the processes from the two polar bodies are indicated as seen under ocular 8, objective 2 millim., and draw-tube 160 millim., and drawn largely with the camera lucida. The egg was in the four-celled stage and about to divide again, so that there were more than eight cells fifteen

minutes later. The double membrane is indicated by two lines some distance from the egg.

At this period the activities of the polar bodies have passed through their first phases and are gradually approaching their more permanent later phases.

Fig. 2.



A more detailed account of these will be given elsewhere, but we will here note that the polar bodies continue to adhere to one another and to the egg for a long time, even if the membrane be removed and they be exposed to the sea-water. When the larva becomes ciliated the polar bodies break loose and float about in the liquid between the larva and its membranes; but they still adhere to one another and are sometimes seen attached to the egg-membrane. Probably they are lost when the larva breaks out from the egg-membranes.

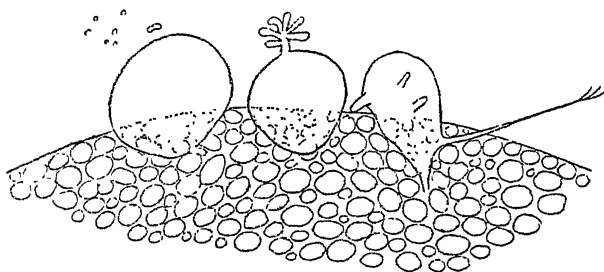
The first and the second polar bodies are markedly different: the first tends to remain more nearly spherical and to continue its radiating *Helioza*-like activities; the second early assumes somewhat the shape of a spindle, and is prone to send out long polar processes looking from the end view like stars and strongly suggesting *free astrospheres*, and from the side view somewhat like test-tube brushes. In later phases the spindle may be much elongated, slender, and with

a marked astrosphere-like mass at each end, so that the entire figure is strangely like similar appearances in caryokinesis.

With exceptional light some of the spin-threads are seen to pass up to the egg-membrane and to branch; others go to the surface of the egg. Here, as in the starfish, the changes that take place, the making of new processes and the withdrawal and bending of old, make it difficult to represent the actual appearances, even if it were possible to adequately express by black lines the optical effect produced by these clear protoplasmic filaments, which bear as much resemblance to fine spun-glasswork as to any other common gross object.

In a nudibranch mollusk, *Tergipes despectus* (?), there are often three polar bodies that remain in close association till the larva is a pyramidal many-celled mass. In some cases a connexion was seen, a changing process or processes, extending between a polar body and the egg and between one body and another; generally the connexion escaped observation, though the bodies acted as if held together. In the case shown in figure 3 the small objects near the largest polar

Fig. 3.



body were seen to change position, and may have been either foreign or loose particles, or else enlargements upon filose processes so fine as to escape detection with the 6 ocular and 2 millim. objective.

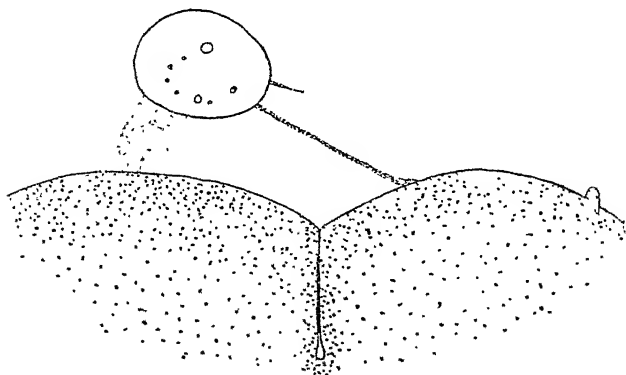
Similar objects near the next polar body proved to be a group of blunt pseudopodia-like outgrowths borne upon a common stalk. From the remaining polar body similar blunt processes projected in various directions separately, and one very long process extended upward to the egg-membrane, where it branched and seemed attached by its several side-threads. This last polar body also sent out a process that apparently attached itself to the surface of the egg, which was still in an undivided state. In other cases blunt processes

and long slender processes were sent out and again drawn in; within a minute a long slender process extended out from a polar body to the egg, and seemed to join to it, and later was represented by a tuft of short, pointed, contracted processes. In many cases the polar bodies showed amœba-like changes of form, with or without pseudopodia; in one case where there were but two polar bodies they crawled over one another with much of the appearance of amœbæ, one of them having a tuft of pseudopodia.

In a lamellibranch mollusk, *Nucula delphinodonta*, the formation and activity of the polar bodies was observed only in some eggs that were probably not fertilized and that did not develop beyond an incomplete first cleavage. The two polar bodies were seen to be connected by a cylindrical mass of clear substance, and, as seen in figure 4, one polar body was seen connected to the egg by means of a long filament as well as by an extensive sheet of faintly refracting material similar to that seen in *Cerebratulus*.

In this case the cleavage had passed in toward the centre of the egg. The small eminence on one side illustrates one

Fig. 4.



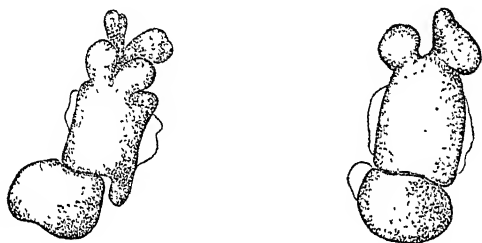
of the several ectosarcal processes that at first were much like protuberances found in *Cerebratulus*, and there giving rise to brushes of fine spin-threads. Here, however, such ectosarcal processes are followed by hernia-like protrusions containing yolk and indicating the abnormal state of the egg.

With the 8 ocular and 4 millim. objective large star-like radiations and central refracting areas were seen near the first polar body as the second one was being formed. Comparing these with appearances seen with the same powers in

Cerebratulus, there is no doubt that there were here also radiating branches of processes similar to those so common at the ends of the second polar body of *Cerebratulus*. The first polar body also showed very fine Heliozoa-like radiations in one case. One polar body showed marked amœboid change of outline, with a rounded blunt pseudopodium.

Such amœboid changes of polar bodies are most pronounced in another lamellibranch, *Angulus tener*. As represented in figure 5, the larger, first polar body takes on a somewhat cylindrical shape at a time when the second is rounded and not entirely free from the egg, and sends out blunt pseudopodia, the two bodies remaining closely appressed. Besides

Fig. 5.



the rounded pseudopodia, which are represented as dark, there were also clear delicate lateral sheets or lamellæ of wavy protoplasm, which are indicated in outline. All these parts rapidly changed, as may be seen by comparing the left-hand view with the right, an interval of scarcely a minute having passed between these two sketches of the same polar body. As these observations were made with the 6 ocular and 2 millim. objective, the failure to see spin-threads here does not disprove their existence; in one case there seemed to be something connecting the first polar body with the egg and passing like a filament between them; but the general character of these polar bodies was that of amœbæ, and not that of filose rhizopods.

To sum up: we find that the polar bodies in certain representatives of the groups—Echinodermata, Mollusca, and Nemertini—show marked activities, differing in different groups and in different subgroups. In several groups the polar bodies have not only amœboid but strongly marked Heliozoan activities. The polar bodies in several groups remain vitally connected with one another and with the developing embryo for some time after their extrusion.

How far these phenomena are normal, and how much of what is above recorded may prove to be pathological, cannot be at present decided; but, in any event, it has been shown that the protoplasm of polar bodies has powers hitherto unsuspected. These need not imply close relationship between polar bodies and Protozoa, but may serve to show that protoplasm expresses itself in radically the same characteristic "protoplasmic" way in Metazoa and Protozoa. These new facts may be added to those recently presented in a comparative study of protoplasm*, and help to bring us toward the new standpoints there reached.

October 18, 1897.

XVI.—*Heterocera from the Transvaal.*

By W. L. DISTANT.

I HAVE recently acquired a small collection of moths made in the neighbourhood of Johannesburg, which contains the following apparently undescribed species:—

Family Arctiidæ.

Spilosoma lemniscata, sp. n.

Head above golden yellow, eyes and antennæ black; pronotum black, the lateral margins and a round spot at base golden yellow; a black spot at humeral angles; abdomen above ochraceous, with the base, central transverse abdominal fasciæ, and lateral spots black; body beneath and legs dark fuscous, anterior femora streaked with ochraceous.

Anterior wings golden yellow, streaked with black—these streaks consist of a submarginal inner fascia, a fascia beneath cell from base to its extremity, where it emits four branches to outer margin (the uppermost disconnected), a streak from within cell to near margin, and a shorter subapical streak or spot; posterior wings dark purplish brown, with the margins golden yellow. Anterior wings beneath as above, but duller in hue; posterior wings beneath with a large basal subcostal yellow patch.

Exp. wings 31 millim.

Hab. Transvaal, Johannesburg.

Allied to *Spilosoma dissimilis*, Dist.

* G. F. Andrews, 'The Living Substance' (Ginn & Co, 1897).

Family Lymantriidæ.

Lacipa quinquepunctata, sp. n.

Head and pronotum silvery white, with ochraceous markings, eyes black, antennæ ochraceous; abdomen above and body beneath and legs very pale ochraceous.

Anterior wings silvery white, with a basal spot and two narrow transverse fasciæ ochraceous—both these fasciæ cross the wing, the first crossing centre of cell, where it is strongly and sinuately bent outwardly, the second oblique and very slightly sinuate beyond cell; extreme basal costal margin black, a small black spot beneath cell and before the first fascia, five black spots between the fasciæ—three at about end of cell and two beneath it bordering outer fascia; an outer submarginal row of small black spots; posterior wings very pale stramineous. Anterior wings beneath (excluding outer and inner margin) pale fuscous; posterior wings with a somewhat obscure discal fuscous spot.

Exp. wings 28 millim.

Hab. Transvaal, Johannesburg.

From *L. quadripunctata*, Dewitz, this species is distinguished by the narrower and more oblique and sinuated ochraceous fasciæ and the five discal black spots to the anterior wings; from *L. sexpunctata*, Dist., it differs not only by the number of spots, but also by the colour of the wings beneath.

Lacipa pulverea, sp. n.

Head and pronotum creamy white, with ochraceous markings, eyes black, antennæ ochraceous; abdomen above, body beneath, and legs ochraceous.

Anterior wings creamy white, crossed by three ochraceous fasciæ—the first subbasal and broken, second crossing cell, third beyond cell, oblique and slightly curved outwardly; some scattered black specks on basal costal margin, a black spot ~~between~~ between first and second fasciæ, between second and third fasciæ a cluster of black speckles at end of cell, and two similar clusters beneath cell; an outer submarginal row of small black spots; posterior wings very thickly covered with fuscous speckles. Anterior wings beneath very thickly covered with fuscous speckles; posterior wings beneath very pale ochraceous, with a few marginal dark spots at apex.

Exp. wings 22 millim.

Hab. Transvaal, Johannesburg.

Family Limacodidæ.

Parasa Johannes, sp. n.

♂. Pronotum pale green; abdomen above ochraceous; head, body beneath, and legs pale castaneous brown; antennæ black.

Anterior wings pale green; a broad outer margin and a broad discal fascia pale castaneous brown; the discal fascia extends from base to a little beyond cell, which it completely occupies, scarcely extending above it, but considerably beneath it, especially at base, its lower margin irregular and excavated, its apex furcate; posterior wings above and beneath pale golden yellow. Anterior wings beneath very pale castaneous brown, the green only more or less faintly visible beneath cell, the brown darkest where the discal and marginal fasciæ exist above.

♀. With the discal fascia to the anterior wings less intense in hue and with the posterior wings rather darker at apex and along outer margin.

Exp. wings, ♂ 35-40, ♀ 42-46 millim.

Hab. Transvaal, Johannesburg.

The length and shape of the discal fascia to the anterior wings is a special point in the identification of this species.

There is a specimen in the British Museum from Natal.

Family Lasiocampidæ.

Dendrolimus metallicus, sp. n.

♂. Body, antennæ, and legs brownish ochraceous, the abdomen somewhat paler in hue.

Anterior wings greyish brown, thickly speckled with pale castaneous, crossed by two oblique, narrow, dark fasciæ, the first crossing cell, the second a little distance beyond it, both directed inwardly; between the second fascia and outer margin a similar obscure, broken, and much waved fascia; all these fasciæ greyish on their inner margins; near extremity of cell a castaneous streak, with a small white spot at its apex; marginal fringe darkest at base; posterior wings pale ochraceous. Anterior wings beneath unicolorous, without fasciæ as above; posterior wings beneath darker than above; both wings with faint signs of a discal oblique paler band.

♀. Anterior wings above with the inner grey margin to fasciæ much more distinct; the discal oblique band beneath also much more developed.

Exp. wings, ♂ 36, ♀ 38 millim.

Hab. Transvaal, Johannesburg.

XVII.—On the Species of the Genus *Viverricula*.

By J. L. BONHOTE.

SEVERAL species of this genus have been made at various times, but latterly most authors have placed them together as one. A careful comparison, however, of the skins and skulls in the British Museum has led me to the following conclusions:—So far as can be judged from the present series, the markings seem to vary considerably in colour, from a rufous to a dark brown in individuals from the same locality; there seem, however, to be three distinct species in the group, each of which might be subdivided into two or more subspecies.

The species are as follows:—

V. malaccensis (Gmel.).—Inhabiting India from Rajputana to the Malay Peninsula.

V. rasse (Horsf.).—Now found (whether introduced or not) in Java, Ceylon, Socotra, Madagascar, and Comoro Islands.

V. pallida (Gr.).—From China and Formosa.

Viverricula malaccensis (Gmel.).

Fiverra malaccensis, Gmel. Linn. Syst. Nat. i. p. 92 (1788); Jerdon, Mamm. Ind. p. 122 (1867).

Fiverra indica, Desm. N. Dict. d'H. N. (2) vii. p. 170 (1817); Horsf. P. Z. S. 1832, p. 23; Elliot, Madr. Journ. x. p. 102 (1839).

Fiverra bengalensis, Gray & Hardw. Ill. Ind. Zool. i. pl. iv. (1830-32).

Fiverra rasse, Elliot, Madr. Journ. x. p. 102 (1839).

Viverricula indica, Hodgs. Ann. & Mag. Nat. Hist. (1) i. p. 152 (1838); id. J. A. S. B. x. p. 909 (1841).

Viverricula rasse, Hodgs. Ann. & Mag. Nat. Hist. (1) i. p. 152 (1838) (probably misprint for *rasse*).

Viverricula rasse, Hodgs. J. A. S. B. x. p. 909 (1841).

Viverricula malaccensis, Blyth, Cat. Mamm. Mus. As. Soc. p. 45 (1863); Anderson, Zool. Yunn. Exp. p. 166 (1879); Blanford, Mamm. Brit. Ind. p. 100 (1888).

This species is so variable in colour and form of markings that I have been unable to find any constant external characters by which it may be easily recognized; the skulls, however, show considerable uniformity, and the auditory bullæ, which are long and compressed laterally, causing them to be deep at the same time, form a character by which the present species may be recognized at any age. The bullæ converge anteriorly, so that there is a considerable narrowing of the anterior end of the basioccipital, and in correlation with this its edges are turned downwards, so as to form a prominent ridge in front of the bulla on either side.

Average measurement of ten adult skulls :—

Basal length 93·8 millim.; zygomatic breadth 44·4; length of palate from henselion 45·7; length of bulla 23; basioccipital, breadth at condyloid foramina 12·7, breadth anteriorly 6·8; greatest diameter of upper carnassial 9·4; least breadth of palate between inner roots of carnassials 12·3.

Specimens from the Malay Peninsula representing the original *V. malaccensis* may be distinguished by having only seven dark rings on the tail instead of eight as in all other specimens, the tip being pure white.

While there are no very tangible differences among specimens from different parts of India proper, there are in the British Museum two specimens from Rajputana so different in appearance that I would make them a subspecies, and propose for them the name

Viverricula malaccensis deserti, subsp. n.

Viverricula malaccensis, Thos. P. Z. S. 1886, p. 55.

Similar in size to *V. malaccensis*. Hair close and long. General colour buffy white, with darker mottlings, but with no distinct markings except a few spots on the flanks. The winter pelage consists of a thick woolly underfur, slate-grey at its base and whitish towards the tip, thickly interspersed with long white bristles having a dark or fulvous tip. The summer coat is similar, except that the underfur is scanty and the bristles greatly predominate. The underside of the neck is of a uniform buffy white, interrupted by two transverse dark bands. The chest and belly are similar to the back, except that the bristles are more scanty and have no dark tip, thus allowing the slate-grey of the underfur to show through. Hands and feet uniform seal-brown. Tail covered with long hair similar to that on the body and marked with alternate rings of dark brown and whitish.

The skull presents no marked differences from that of a typical *malaccensis*.

Dimensions of the type (an adult male measured in the flesh) :—

Head and body 581 millim.; tail without hair 401; ear 30; hind foot 99.

Skull: basal length 94; zygomatic breadth 45; length of palate from henselion 45·7; length of bulla 22; basioccipital, breadth at condyloid foramen 13, breadth anteriorly 6·5; greatest diameter of upper carnassial 10; least breadth of palate between inner roots of carnassials 12·3.

Hab. Rajputana.

Type B. M. 85. 8. 1. 27. Sambhar, Rajputana. Collected by Mr. R. M. Adam, 17th December, 1877, and presented by Mr. A. O. Hume.

A second specimen, obtained at Nusserabad, in the same province, in August 1878, has been recently presented to the Museum by Col. J. W. Yerbury, and agrees in all respects with the type.

This subspecies, which differs in habits from the true *malaccensis* by frequenting desert country instead of forests, may be easily distinguished by its very light colour and the absence of any distinct stripes on the back.

Viverricula rasse (Horsf.).

Viverra rasse, Horsf. Res. Java, pl. xviii. (1824); id. P. Z. S. 1832, p. 23; Peters, Reise nach Mossambique, Mamm. p. 113 (1852).
Viverricula Schlegeli, Pollen, Ned. Tijds. Dierk. iii. p. 78 (1866).

This species does not differ externally from *V. malaccensis*, except in its smaller size, and, although as a whole it varies as much as the preceding one, yet individuals from the same locality appear to be fairly constant in colour and markings.

Horsfield's statement that *V. rasse* has eight broad longitudinal lines on the back, the three lateral lines on each side interrupted and obscure, while *V. malaccensis* has eight narrow longitudinal lines, the lateral lines continued, does not appear to hold good for all individuals.

The skull, however, shows marked differences from that of *V. malaccensis*, the auditory bullæ being much shorter, flatter, and not converging so much towards the middle line, thus causing the basioccipital to be considerably broader at its anterior end and not folded into ridges when it leaves the bulla.

Dimensions of the skull of one of Horsfield's typical specimens (B. M. 74):—

Basal length 86 millim.; zygomatic breadth 42; length of palate from henselion 43; length of bulla 20; basioccipital, breadth at condyloid foramen 11.5, breadth anteriorly 8; greatest diameter of upper carnassial 9; least breadth of palate between inner roots of carnassials 12.

Specimens from the various islands appear to differ slightly from each other, but the material at hand does not seem to me sufficient to justify at present the subdivision of the species.

Viverricula pallida (Gr.).

Viverra pallida, Gray & Hardw. Ill. Ind. Zool. ii. pl. vi. (1833-34); Swinhoe, P. Z. S. 1862, p. 353; Gray, P. Z. S. 1864, p. 514.
Viverricula malaccensis, Swinhoe, P. Z. S. 1870, pp. 227, 630.

This species is considerably larger than *V. rasse*. The markings are not usually very distinct and the general colour is suffused with fulvous. It may be distinguished from both the preceding species by the absence of the transverse markings on the underside of the neck.

The skull differs only from that of *V. rasse* by its greater size.

Dimensions of a skull from Formosa (a small specimen):—

Basal length 87 millim.; zygomatic breadth 45; length of palate from henselion 43; length of bulla 20; basioccipital, breadth at condyloid foramen 12·7, breadth anteriorly 9; greatest diameter of upper carnassial 10; least breadth of palate between inner roots of carnassials 13.

These dimensions are far exceeded in the other skulls, but these are given as it is the only skull sufficiently perfect to allow all the measurements to be taken on it. The largest skull has a zygomatic breadth of 49 millim. and greatest diameter of upper carnassial 10·5 millim.

This species varies less than the others; the markings are almost always indistinct and generally absent on the fore part of the body. Swinhoe thought Formosan examples slightly different, but the specimens in the British Museum do not bear out that conclusion.

Key to Species of Viverricula.

- A. Basioccipital converging anteriorly, bullæ long.
 - a. Markings distinct *V. malaccensis*.
 - b. Markings indistinct..... *V. m. deserti*.
- B. Basioccipital scarcely converging anteriorly, bullæ short.
 - a. Dark transverse band on throat *V. rasse*.
 - b. No dark transverse band on throat *V. pallida*.

XVIII.—*A List of Reptiles and Batrachians from Ombai, East Indian Archipelago.* By G. A. BOULENGER, F.R.S.

IN a previous number of these 'Annals' * I contributed a list of the Reptiles and Batrachians collected by Mr. Alfred Everett in Lombok, Flores, Sumba, and Savu. Thanks to the exertions of the same traveller I am now able to supplement our knowledge of the herpetology of that chain of islands by giving a list of the Reptiles and Batrachians obtained by him on Ombai. All belong to known species.

LIZARDS.

1. *Hemidactylus frenatus*, D. & B.

* Ser. 6, vol. xix. 1897, pp. 503-509.

2. *Hemidactylus Brookii*, Gray.

I am now convinced that *H. Gleadowii*, Murray, cannot be regarded as specifically distinct from *H. Brookii*, the range of which extends across tropical Africa to India, Ceylon, Further India, Southern China, and the Malay Archipelago, where it is on record from Borneo, whence the type specimens are stated to have been obtained.

3. *Gehyra mutilata*, Wiegman.4. *Gecko verticillatus*, Laur.5. *Draco timorensis*, Kuhl.6. *Mabuia multifasciata*, Kuhl.

7. *Lygosoma floreense*, M. Weber.

8. *Lygosoma smaragdinum*, Less.

9. *Ablepharus Boutonii*, var. *furcatus*, M. Weber.

SNAKES.

10. *Lycodon aulicus*, L.

11. *Coluber subradiatus*, Schleg.

It not unfrequently happens that the subocular below the præocular is not separated from the fourth labial, in which case three labials enter the eye, as in *C. enganensis*, which differs only in the deeper rostral. We have now eight specimens in the British Museum, with the following number of scales and shields:—

			Upper labials entering eye.	Scales.	Ven- trals.	Caudals.
1. ♂.	Timor.	Leyden Mus.	4th, 5th	23	233	93
2. ♀.	Atapupu,	Timor. Everett.	4th, 5th	23	246	91
3. ♀.	Ombaai.	Everett.....	3rd, 4th, 5th	23	242	88
4. ♀.	"	"	4th, 5th —3rd, 4th, 5th	23	228	90
5. Hgr.	"	"	3rd, 4th, 5th	23	226	97
6. ♂.	Sumba.	"	4th, 5th	25	233	102
7. ♂.	Flores.	"	3rd, 4th, 5th, —4th, 5th	25	248	?
8. Hgr.	—?	Bleeker	4th, 5th	23	230	96

12. *Dendrophis pictus*, Boie.

13. *Naia tripudians*, Merr.

A female specimen uniform brown above and whitish

beneath, same variety as recorded by me from Flores. Sc. $\frac{21}{19}$; V. 179; C. ?.

14. *Lachesis gramineus*, Shaw.

FROGS.

15. *Rana tigrina*, Daud.

16. *Hyla Everetti*, Blgr.

XIX.—Descriptions of Two new Blind Snakes.

By G. A. BOULENGER, F.R.S.

Typhlops albiceps.

Snout rounded, moderately projecting; nostrils lateral. Rostral two fifths the width of the head, extending to between the eyes; nasal incompletely divided, the cleft extending from the second labial to a little beyond the nostril; præocular as broad as the nasal or the ocular; eyes just distinguishable; præfrontal, frontal, and interparietal moderately large, equal, slightly larger than the supraocular; four upper labials, third and fourth in contact with the ocular, second and third with the præocular. Diameter of body 64 times in the total length; tail as long as broad, ending in a spine. 18 scales round the body. Pale brown; head, anal region, and end of tail white.

Total length 128 millim.

A single specimen from Chantaboon, Siam. Received in exchange from the Royal Siamese Museum, Bangkok.

Typhlops leucostictus.

Snout rounded, very prominent; nostrils inferior. Rostral one third the width of the head, extending to between the eyes; nasal completely divided, the cleft proceeding from the second labial and not extending to the upper surface of the snout; præocular a little narrower than the nasal, a little broader than the ocular; eyes just distinguishable; præfrontal, frontal, and interparietal scarcely enlarged, a little smaller than the supraocular; four upper labials, third and fourth in contact with the ocular, second and third with the præocular. Diameter of body 45 times in the total length; tail as long as broad, ending in an obtuse spine. 22 scales round the body. Dark brown above, the scales edged with whitish, with scattered small white spots; whitish beneath, each scale brown at the base.

Total length 225 millim.

A single specimen from Liberia.

XX.—*Some Bees of the Genus Megachile from New Mexico and Colorado.* By T. D. A. COCKERELL, Entomologist of the New Mexico Agricultural Experiment Station.

Megachile Wootoni, sp. n.

♂.—Length about 13 millim.

Moderately robust, black, with rather thin yellowish pubescence. Head ordinary, facial quadrangle about square, face up to level of antennæ with dense cream-coloured pubescence; vertex with large close punctures and thinly clothed with long yellowish hair, *with some shorter black ones intermixed*; cheeks broad, very thinly pubescent, lower part with a conspicuous broad transverse band of yellowish-white hair; antennæ wholly black, *last joint broadened and flattened*; mandibles tridentate, more or less elbowed, fringed beneath with shining yellow hair beyond the bend; *a rounded tubercle at base of mandible beneath*, tufted with yellowish hair; mesothorax strongly and closely punctured, with thin erect pubescence, yellowish on anterior half, *mostly black on posterior half*; scutellum and pleura with longer and denser hair, that on the pleura yellowish white; tegulæ black; wings dusky hyaline, broadly darker on apical margin; nervures black, second submarginal cell receiving second recurrent nervure a short distance before its apex; legs black, with yellowish-white hair; four hind femora and tarsi ordinary, the tarsi with fulvous hair on inner side; spurs ferruginous; middle coxæ ordinary; anterior coxæ with a stout tooth, above which at base is a well-defined patch of shining coppery hair; the tooth itself has a pale stripe on one side; *anterior femora pale orange ferruginous, with a black apex and a black stripe on outer side from base to apex*; anterior tibiæ ferruginous within, black without, broadly pale yellowish at apex, *with a broad rounded lamina projecting at right angles*; *anterior tarsi cream-colour*; *first joint hollowed, canoe-shaped*, a little produced at end, but not as far as tip of second joint, its end rounded; the basal two thirds of its inner edge with a narrow fringe of very short fuscous or black hairs; *its outer margin near the base within with some very short black hairs, not forming a distinct patch*, and easily overlooked; its hind margin with the usual long fringe of pale hair, of which the inner hairs are strongly tipped with black; remaining joints of anterior tarsi gradually diminishing, formed as in allied species; abdomen rather short, fairly broad, nearly parallel-

sided; with thin erect pubescence, *yellowish on the first two segments and the first half of the third, beyond that black, with a little yellowish intermixed; no tendency to hair-bands; apical segment with a very broad and deep semicircular emargination; subapical ventral teeth placed in a broad triangle, all large and long, pointed.*

Hab. Ruidoso Creek, New Mexico, 7800 feet, July 6, asleep on a plant doubtfully referred to *Vicia americana* (E. O. Wooton, 57). I had taken this for *M. fortis*, but it is perfectly distinct, and is apparently more allied to *M. melanophæa*, Smith. The real *M. fortis* was taken by Prof. Townsend on the west fork of the Gila River, July 16.

Megachile perihirta, sp. n.

♂.—Length about 12 millim.

Moderately robust, black, with rather thin yellowish pubescence. Head ordinary, facial quadrangle a little longer than broad, slightly narrowed below; face up to level of antennæ with dense cream-coloured pubescence, but the very closely punctured clypeus, though somewhat hidden beneath a long projecting supraclypeal fringe, is itself pubescent only at the sides; vertex with strong close punctures and erect yellowish pubescence, *not mixed with black*; cheeks broad, thinly pubescent, *with two oblique bands of white hair on lower part*; antennæ wholly black, last joint somewhat flattened, *but hardly broadened*; mandibles not elbowed, *lower edge with a conspicuous yellowish-ferruginous stripe; behind base of mandibles is a broad projecting lamella, with a narrow line of minute white pubescence on its anterior face*; mesothorax dull, very closely punctured, with erect pubescence not hiding the surface, *nowhere mixed with black*; about equally dense and of the same yellowish colour on scutellum and pleura; tegulæ piceous, closely punctured; wings dull hyaline, broadly dusky at apex; nervures black, second submarginal cell long, receiving second recurrent nervure almost at its apex; legs black, with pale hair; middle femora incrassate, middle tibiæ arcuate; middle tarsi simple, but first joint very pubescent, and with a long brush of pale hair behind; spurs whitish; hind tarsi within with copious orange-fulvous pubescence; first joint of hind tarsi somewhat broadened; anterior coxæ with a strong spine, at base of which is no bright pubescent patch; anterior femora orange-fulvous, apical two-thirds black on outer surface, and on inner surface having a black stripe; anterior tibiæ orange-fulvous becoming ferruginous, pellucid yellowish white at apex, on outer surface with a

black patch, on inner edge with a black stripe, apex with a small dentiform projection; anterior tarsi cream-colour, somewhat suffused with pale ferruginous, the last joint pale ferruginous; first joint deeply hollowed, but not very broad, not much produced at end, *the margins of the hollow fringed with dark rufous hair*, the hind margin with the usual long pale fringe, the inner hairs of which are black at ends; second to fourth joints of anterior tarsi successively smaller, almost bilaterally symmetrical; *abdomen with very distinct punctures*, broad and short, the lateral margins gently concave, clothed with erect yellowish hair, not concealing the surface, not mixed with black, not at all tending to form bands; apex with a small emargination, on each side of which are two or three irregular teeth; apical ventral segment obtusely angled in the middle, with a small tooth on each side.

Hab. Colorado Springs, Colorado, middle of July (*Ckll.* 3571). At the same locality and time I took a form of *M. fidelis*, Cress., a little different from specimens found in New Mexico.

Megachile Casadæ, sp. n

♂.—Length about $13\frac{1}{2}$ millim.

Black, with dull white pubescence. Head ordinary, but rather large; eyes sage-green; facial quadrangle nearly square, slightly longer than broad, hardly at all narrowed below; face with white hair, absent about the middle of the shining well-punctured clypeus; vertex shining, with large punctures, thinly pubescent, some black hairs just behind the ocelli; cheeks quite hairy, sloping away behind eyes; antennæ black (broken at ends in type specimen); mandibles wholly black, no tooth or tubercle behind their base; mesothorax dullish, strongly and closely punctured, thinly clothed with dull white pubescence, some inconspicuous black hairs on hinder part; scutellum quite shiny; tegulæ piceous, with minute punctures; wings dusky hyaline, nervures black, recurrent nervures entering second submarginal cell very near its base and apex; anterior coxæ with a rather short spine, having a light yellowish patch at apex; anterior femora orange-rufous above and below, black behind, with long white hair, and having a broad black stripe from base to apex in front; anterior tibiæ orange-fulvous beneath and at apex, also the anterior half (longitudinally) within, otherwise black; a small erect spine at apex; anterior tarsi light yellow, the last joint blackish except at base; the joints are not much modified, but the second to fourth are oblique, emarginate at end; the first has a rather shallow groove, and all are black

on the inner hind margin behind the long fringe, which is as in the species with highly modified tarsi, and is wholly white viewed from without, but within the hairs are black for their whole length. The four hindmost legs are black; middle tibia with a rufous spine at apex; middle femora quite stout; spurs pale ferruginous; middle tarsi with a very long fringe of white hair behind; hind tarsi with orange-fulvous hairs on inner side; abdomen fairly broad, parallel-sided, punctured, second and third segments more or less depressed at base; first segment broadly excavated, so that the dorsal (as distinguished from the anterior) surface is very small; pubescence very thin, white; the hind margins of the segments with dense white hair-bands, that on the first thin and weak; apex not at all emarginate, irregularly notched on each side of the middle; the three subapical ventral teeth in the same transverse plane, the middle one long and sharp, the lateral ones short, broad, and blunt.

Hab. Las Cruces, New Mexico. One in the collection of the New Mexico Experiment Station, probably collected by Prof. Townsend. It had been studied by Miss J. E. Casad, who left some descriptive notes.

The following table separates the males of *Megachile* with peculiar front tarsi which are found in New Mexico, including also the species from Colorado described above. All have spines on the anterior coxæ.

Abdomen without hair-bands	1.	
Abdomen with hair-bands	2.	
1. Last joint of antennæ dilated and flattened; subapical ventral teeth of abdomen very large; abdomen with much black hair		<i>Wootoni</i> , sp. n.
Last joint of antennæ not or hardly dilated; subapical ventral teeth of abdomen small; abdomen without black hair.		<i>perihirta</i> , sp. n. (Colo.)
2. First joint of anterior tarsi produced to a free apex	3.	
First joint of anterior tarsi not produced to a free apex	4.	
3. The free apex like the end of a finger; hair-bands of abdomen fulvous		<i>fidelis</i> , Cress.
The free apex not like the end of a finger; hair-bands white		<i>pugnata</i> , Say.
4. Thorax very pubescent, the pubescence more or less ochreous or fulvous	5.	
Thorax not very pubescent, the pubescence pale greyish to white	7.	
5. Flagellum slender, not crenulated beneath.		<i>latimanus</i> , Say.
Flagellum stout, crenulated beneath	6.	
6. Pubescence of thorax yellowish grey		<i>comata</i> , Cress.

- Pubescence of thorax fulvous *fortis*, Cress.
 7. Anterior legs slender; anterior tarsi with
 basal joint merely expanded into a flat
 lamina at the side *occidentalis*, Fox.
 Larger; anterior femora stout, subtriangular
 in section 8.
 8. Anterior femur yellow where it touches
 tibia; pubescence of face yellowish; a
 white band of pubescence at scutello-
 mesothoracic suture *sidalceæ*, Ckll.
 Anterior femur rufous where it touches
 tibia; pubescence of face white; no band
 of pubescence at scutello-mesothoracic
 suture *Casadæ*, sp. n.

The following are new to the fauna of New Mexico :—

Megachile comata, Cress. 1872.

Tuerto Mountain, near Santa Fé, 8025 feet, Aug. 7, at flowers of *Senecio* (Ckll.).

Megachile pugnata, Say, 1837.

Five males from Santa Fé (Ckll.); one, July 11, at flowers of *Lactuca pulchella*; two at flowers of *Rudbeckia laciniata*, July 27 and Aug. 2; one, July 6; one, July 18.

Megachile latimanus, Say, 1823.

Three at Santa Fé (Ckll.); one ♀, July 25, at flowers of *Sphæralcea angustifolia*; one ♂, Aug. 1, at flowers of *Cleome serrulata*; one ♂, Aug. 3, inside closed flower of *Argemone platyceras*.

Megachile texana, Cress. 1878.

Ruidoso Creek, 6400 feet, July 8, at flowers of *Pentstemon*, two females (E. O. Wooton).

Megachile Townsendiana, sp. n.

♂.—Length about $10\frac{1}{2}$ millim.

Black, with scattered white pubescence. Head large, transversely oval; eyes sage-green; facial quadrangle a little longer than broad, perceptibly narrowed below; face (including clypeus) densely clothed with white hair; vertex strongly punctured, with very sparse white pubescence; cheeks sparsely pubescent above, densely clothed with white hair below; antennæ black, flagellum slender, last joint not broadened; mandibles wholly black, the long hairs on their inferior margin whitish; mesothorax very strongly and

closely punctured; thoracic dorsum almost nude, the white hairs few and scattered, except at the scutello-mesothoracic suture, where they are dense enough to form a band, and on anterior part of mesothorax, where they form two obscure sublateral longitudinal bands; tegulæ testaceous; wings hyaline, nervures dark brown, second submarginal cell receiving first recurrent nervure almost at its extreme base, and second near its end; legs black, with white pubescence, pale orange on inner side of tarsi; spurs whitish; all the legs slender and simple; anterior coxæ with the usual stout spines; abdomen short and broad, rather shiny, strongly and closely punctured, hardly at all pubescent, except that the hind margins of the first four segments have dense white hair-bands, the last being continued on to the base of the fifth; sixth segment densely white-pubescent at base, at apex narrowed, produced and emarginate, the outline being like that of the two humps of a camel, but viewed from the side the outline is that of a rose-thorn, the end being curved downwards; beneath, the apex presents an obtuse median prominence and a short tooth on each side, laterad of which is an angle representing an incipient tooth; venter very sparsely pubescent.

Hab. Las Cruces, New Mexico, Aug. 23, 1897, at flowers of *Chrysopsis villosa* in the *Larrea*-zone (*C. H. T. Townsend*). Another, also from Las Cruces, is only 9 millim. long, but evidently conspecific.

M. Townsendiana by the shape of the apex of the abdomen recalls *M. deflexa*, Cress., from Kansas, but in the latter the tip is not emarginate and the mesothorax and vertex show black hairs.

XXI.—*A North-American Freshwater Jellyfish.*

By EDWARD POTTS*.

ON June 10, 1880, the first-known freshwater jellyfish (*Limnocoedium Sowerbiæ*, Allman and Lankester) was discovered in the Victoria Regia tanks in Regent's Park, London. Near the end of November 1884 a primitive "hydriform organism," from which it was supposed the jellyfish might have been derived, was found in the same tanks and described by Alfred Gibbs Bourne†.

* From 'The American Naturalist,' December 1897, pp. 1032-1035; communicated by the Author.

† 'Proceedings of the Royal Society,' Dec. 11, 1884, vol. xxxviii. p. 9 &c. See also paper by F. A. Parson, Journ. of Queckett Club, 2nd series, vol. ii. 1885-86.

About two months after Mr. Bourne's discovery I first detected *Microhydra Ryderi* upon some stones collected the previous autumn from the rocky bed of Tacony Creek, a rapidly flowing mill-stream near Philadelphia, Pennsylvania, a small affluent of the River Delaware, but far above tide-level. Some peculiarities in its structure and mode of gemmiparous multiplication were described by my valued friend the late Dr. John A. Ryder*.

Dr. Ryder had not, at the time of writing the above paper, seen the living organism which he there described. Specimens were, however, some years later placed in his hands for study and watched for many months with exceeding interest. His early death has left in the possession of his representatives many excellent drawings and some valuable micro-slides as the only evidences of his interest and labour. No descriptive text has been found; and the sorrow that his many friends feel at his early removal has, to me, this added regret—that he was not able to complete an investigation, which, not unnaturally perhaps, I felt to be of so great importance, and that he cannot now share with us our great delight in witnessing the further development from *Microhydra Ryderi* of a “medusiform adult stage.”

As may be seen by a comparison of the papers above named, all of them preliminary and incomplete, there are obvious points of resemblance as well as of difference between these minute organisms that appeared, almost simultaneously, at geographical points so widely distant. The supposition that the form observed by Mr. Bourne is the earlier condition of *Limnocodium* is, of course, greatly strengthened by my actual observation of the budding and separation of free-swimming Medusæ from *M. Ryderi* †.

We read that the specimens of *Limnocodium* often, perhaps generally, disappeared from the tanks about the end of June or July ‡. It is greatly to be regretted that the glass jars containing my species were not carefully examined throughout June and July of the present year, during which period there may have been a larger production of maturing jellyfish. On the first day of August, however, my attention was arrested by the spasmodic contraction of an evident Medusa in the above-mentioned jar, and, during several following days, Prof. E. P. Cheyney and myself, on frequent occasions, watched the swelling buds upon colonies of *Microhydra* that

* ‘American Naturalist,’ Extr., Dec. 1886, p. 1232 &c.

† This alternation and progression may have been seen, later, in England, but I shall have to plead ignorance of the fact.

‡ In one case “swarms” are reported Aug. 18, 1882, at Kew Gardens.

had attached themselves to the glass. We witnessed the spreading of the disk, disclosing, from the first, eight marginal tentacles, a well-defined velum whose aperture was from one third to one fourth the diameter of the disk, and a manubrium depending, about one half the height (or depth) of the bell. Violent pulsating spasms finally resulted in an entire separation from the hydroid and the free life of a roving medusa. I kept no record of numbers, but it is believed that from twelve to twenty were seen.

Measurements were difficult, but, as nearly as I could make it out, the jellyfish was at this time about $\frac{3}{4}$ of an inch in diameter. It was of a somewhat prolate dome-shape, and when seen from the polar aspect the manubrium had a clearly quadrate appearance, from whose corners or lobes four radial canals curved downward to the marginal canal. At every point of junction occurred a single tentacle, and another of equal size was found midway between them. These eight tentacles (the only number as yet observed), always pendent, were plentifully charged with thread-cells, and, while susceptible of much variation in length, were not seen much longer than one half the diameter of the disk.

As to temperature, it is obvious that the water of the jars in which this Medusa was developed must have had nearly that of the surrounding atmosphere, with its diurnal changes—say from 60° to 85° at this season; during the winter, in our heated rooms, the temperature is probably more uniform. The hydroid form, in Tacony Creek, being but a few inches below the surface, must be subjected frequently to a temperature at or below the freezing-point.

It is quite improbable that under the present artificial conditions any Medusæ will attain full maturity this season. It is therefore manifestly unsafe to compare their minute size and general appearance with the totally dissimilar drawings given us of *Limnocodium*, where the latter had attained a diameter of about $\frac{1}{2}$ an inch. The full life-history of the organism must therefore be again left imperfectly recorded; but I am happy to be able to state that my friend Dr. Charles B. Davenport, of Harvard University, has consented to undertake the further technical study of it from material we have recently collected, and the drawings &c. left by Dr. Ryder, and to hope that many points now obscure may, through his efforts, be solved.

To aid the search of others for this—probably the most primitive Cœlenterate—it may be well to state that in my experience I have only found *M. Ryderi* in a natural condition, living as a messmate among colonies of Bryozoa that

may be considered almost perennial in habit, where its own disabilities as a food-collector, on account of local inertia and the total absence of tentacles, were supplemented by the life-sustaining currents induced by its more active neighbours. These conditions are near Philadelphia furnished by *Urnatella gracilis*, Leidy, and *Pottsiella erecta*, Kræpelin (*Paludicella erecta*, Potts). I regret to be obliged to add that I am not aware that either of these has been collected in any other neighbourhood.

Philadelphia,
August 19th, 1897.

XXII.—A Revision of the Butterflies of the Genus *Ixias*.

By ARTHUR G. BUTLER, Ph.D., F.L.S., F.Z.S., &c.

THE present genus is confined to the Old World, being found throughout India and Ceylon, Burmah, Siam, China, and south-eastwards to the Celebes and Timor.

Ixias in general aspect resembles certain groups of the genus *Teracolus*, but is readily distinguishable by the neuraction, the first two branches of the subcostal vein in the primaries being emitted wider apart, the upper radial emitted from the subcostal vein well beyond the end of the cell (expressed in the recently adopted phraseology this would stand as "veins 6, 7, and 8 stalked"). In the secondaries the discocellulars are much more oblique than in *Teracolus*.

The seasonal variation of *Ixias* differs somewhat from that of *Teracolus*, nor is it quite consistent in its character throughout the genus. As a rule the wet form has heavy borders to the wings on the upper surface and scarcely any markings on the under surface (often only a black dot at the end of the discoidal cells and a spot at the external angle of the primaries), but in some of the species there appears to be no wet phase of marking and coloration, and in others the wet-season form shows dark spots on the under surface occupying the exact positions of the ocelloid markings characteristic of the dry season.

Group 1. (Type *I. venilia*.)

Apical two thirds of primaries above veined with black; under surface always showing dry-season markings; the only probable seasonal difference consisting in the width of the border of the secondaries on the upper surface; it is not,

however, certain that this difference in the present group has a seasonal significance, though it is certain that it has no specific value, as hitherto supposed.

1. *Ixias Reinwardtii*.

Thestias Reinwardtii, Vollenhoven, Tijd. Ent. iii. p. 125 (1860); Monog. Pier. p. 50, pl. vi. fig. 1 (1860).

Lombok, Flores, and Laraut, near Timor. B. M.

We have nine examples in the Museum series and three in the Hewitson collection; one female from the Godman and Salvin collection is unusually black on the upper surface, the white markings on the apical area being very much reduced and those towards the apex obliterated.

2. *Ixias pulchrior*, sp. n.

♂. Allied to the preceding, but the ash-grey suffusion at the base clearer and more restricted, the disk (beyond the orange patch) sulphur-tinted; the discal interrupted stripe terminating above the third median branch, the outer border and blackened veins narrower.

The female differs more markedly, the white patches beyond the cell of primaries being washed with orange and widened and extended so as to be continuous with the white area below the cell; the border of the secondaries is also similar to that of the male, not widened and bordered with grey scaling as in *I. Reinwardtii*. The under surface of both sexes differs from the latter chiefly in being less marked with black, the general pattern and coloration being very similar.

Expanse of wings, ♂ 58–61, ♀ 64 millim.

Bali Island (*Wallace*). B. M.

There are four examples in the Museum series and two in the Hewitson collection.

3. *Ixias Piepersi*.

Thestias Piepersi, Snellen, Tijd. Ent. xxi. p. 31, pl. ii. figs. 1, 2 (1878).

Celebes.

Not in the Museum series. It is a curious insect, combining characters of *I. Reinwardtii* and *I. venilia*, so that it is difficult to know exactly where to place it in a linear series.

4. *Ixias Kühni*.

Ixias Kühni, Röber, Tijd. Ent. xxxiv. p. 287, xxxv. pl. iv. figs. 3, 4 (1892).

Wetter. B. M.

Three males bearing a manuscript name of Staudinger's were received in the Godman and Salvin series.

5. *Ixias venilia*.

♂. *Pieris venilia*, Godart, Enc. Méth. ix. p. 121 (part.) (1819); Lucas, Lep. Exot. pl. xxxvi. fig. 1 (1835).

♂ ♀, Java (*Horsfield*). B. M.

One of M. Godart's typical examples was identical with Wallace's *I. venatrix*.

6. *Ixias Vollenhovii*.

Thestias Vollenhovii, Wallace, Trans. Ent. Soc. ser. 3, vol. iv. p. 393 (1867).

Thestias venatrix, Wallace, l. c.

Pieris venilia, Godart, Enc. Méth. ix. p. 121 (part.) (1819).

Timor, Dili, Semão, Java. B. M.

Eleven examples in the Museum series and four in the Hewitson collection. *I. venatrix* appears to be the dry-season form and is linked to typical *I. Vollenhovii* by an example received in the Godman and Salvin series. Wallace wrongly gave Moulmein as the locality of his *I. venatrix*, supposing that "E. Indies" indicated one of the specimens so labelled from Archdeacon Clerk's collection; had either he or Capt. Watson looked up the register number this error would have been discovered and saved much perplexity.

7. *Ixias insignis*.

Ixias insignis, Butler, Cist. Ent. ii. p. 431, pl. viii. fig. 1 (1879).

♂, Formosa. Type B. M.

8. *Ixias balice*.

Thestias balice, Boisduval, Sp. Gén. Léop. i. p. 593 (1836).

♂, Java. B. M.

Group 2. (Type *I. flavipennis*.)

The ground-colour of all the wings above golden yellow.

9. *Ixias flavipennis*.

Ixias flavipennis, Grose-Smith, in Forbes's Nat. Wand. p. 275 (1885).

Ixias pyritus, Weymer, Stett. ent. Zeit. 1886, pl. i. fig. 4; 1887, p. 13.

Sumatra (*Major Fawcett*), two males. B. M.

Group 3. (Type *I. pyrene*.)

This is the largest and most perplexing group in the genus, and it is possible that I may not have sufficiently reduced the number of named species; this, however, is, I think, preferable to reckless sinking of forms which are locally constant under one heading. In the late Capt. E. Y. Watson's review of the Indian species it is difficult to comprehend his meaning; he regards the whole of the species of the present group as one; but he says:—" *I. pyrene* is very subject to both climatic and seasonal variation, and many forms have been named. Of these some are fairly distinct, and the males can be compared as below. . . ."

Now it seems to me that to discriminate between "a distinct climatic form" and "a species" we must have a universally accepted definition of what a species is, which is impossible: therefore, to my mind, if a thing is distinct it ought not to receive the same name as that from which it is admitted to be distinct, for to give the same name to two distinct things is to stultify the very object aimed at in nomenclature.

In the present group the wet-season forms are usually almost unmarked below and the dry forms heavily speckled and ocellated, whilst the outer borders on the upper surface are, as a rule, considerably broader in the wet than in the dry forms, sometimes disappearing entirely from the secondaries of the latter.

10. *Ixias rhexia*.

♂. *Papilio rhexia*, Fabricius, Syst. Ent. p. 476 (1775); ♀. Butler, Cat. Fabr. p. 216, pl. i. fig. 5 (1870).

♀. *Papilio pirithous*, Fabricius, t. c. p. 483 (1775).

♀. *Ixias familiaris*, Butler, Trans. Ent. Soc. 1874, p. 432.

Ranges from Tibet through N.E. India into Burmah. Twenty-nine examples. B. M.

There are five examples in the Hewitson collection, one of which is a remarkable albino male, having a white instead of orange patch on the upper surface of the primaries.

11. *Ixias evippe*.

Papilio evippe, Drury, Ill. Exot. Ent. i. pl. v. fig. 2 (1773).

Ixias anaxibia, Hübner, Verz. bek. Schmett. p. 95 (1816).

S.E. China and the Island of Hainan. B. M.

The Museum series consists of thirteen examples, and there is one specimen in the Hewitson collection. *I. anaxibia* is the dry form and *I. evippe* the wet.

This and the preceding species have long been confounded,

but the Chinese and Indo-Burmese forms differ somewhat. Taken collectively *I. evippe* runs somewhat smaller than *I. rhexia*, never attaining the expanse of wing which some of the wet-season examples of that species show; the form of the wings in *I. evippe* is also rounder and more regular, the orange belt on the primaries is distinctly broader and extends further back into the discoidal cell, its front edge is diffused instead of sharply outlined; the seasonal forms also differ less in size and in the width of the border on the upper surface of the secondaries than in *I. rhexia*.

12. *Ixias undatus*.

Ixias undatus, Butler, P. Z. S. 1871, p. 252, pl. xix. fig. 4.

Borneo. Ten specimens (all males). B. M.

There is also one male in the Hewitson collection. It is curious that the female does not come to hand.

13 *Ixias latifasciatus*.

Ixias latifasciatus (part.), Butler, P. Z. S. 1871, p. 252, ♂.

Tenasserim, Burmah. B. M.

We possess ten examples of this species, of which seven belong to the dry-season form and exhibit the heavily black striated under surface which seems peculiar to this species. The female which I figured is that sex of *I. verna* (a white-winged species), which fact probably confused the late Capt. Watson, who regarded the present species as a form of *I. pyrene* rather than *I. rhexia* (to which it is much more nearly related); also, not having taken special notes of the type specimens, he erroneously identified the wet form of the species as typical, and (not possessing the dry form of the male) naturally concluded that the species was based upon an extreme seasonal form of *I. pyrene*. The seasonal forms of *I. latifasciatus* hardly differ on the upper surface; the border varies slightly in width in examples both of the wet and dry forms, one of our wet-season males showing a rather narrower border to the secondaries than any of our dry-season examples. Apart from the ground-colour of the wings this species is not at all unlike *I. verna*.

14. *Ixias Birdi*.

♂. *Ixias Birdi*, Distant, Ann. & Mag. Nat. Hist. ser. 5, vol. xii. p. 351 (1883); Rhop. Mal. pl. xxvi. fig. 4 (1882-86).

♂. Allied to the preceding species, slightly smaller, with the orange belt on the primaries sharply defined and more

golden in colour; the black border of the secondaries considerably narrower (about the width of that in *I. cingalensis*, but slightly wider towards anal angle); under surface clear lemon-yellow, marked as in the typical *dry-season* form of *I. latifasciatus*.

Expanse of wings 59 millim.

Dry form, ♂, Perak (*Townsend*); from G. and S. coll.

Although we only have one example of this species, I am quite satisfied of its distinctness. The type was a wet-season form.

15. *Ixias cingalensis*.

Ixias cingalensis, Moore, Lep. Ceylon, i. p. 126, pl. i. figs. 2, 2 a (1881).

Ceylon. B. M.

We have thirteen examples of this species, four of which are wet-season males and the remainder dry-season specimens of both sexes. The Hewitson collection contains four examples.

Capt. Watson extended the range of this species over Southern India and regarded *I. rhoda* = *I. kausala* as the dry form of the species; but the wet and dry forms of *I. cingalensis* are absolutely identical on the upper surface, nor does *I. kausala* invariably possess the character upon which Capt. Watson defined *I. cingalensis*, for he says:—"It can be separated at once from all other forms of yellow *Ixias* by the greater extent of the basal yellow of the fore wing, which spreads into the upper median interspace." In our specimens of *I. kausala* the "basal yellow" extends more, less, or not at all into the upper median interspace.

I. cingalensis can be picked out at sight from a crowd of nearly allied forms, but the distinction given above is useless as a guide; its chief peculiarity is the narrowness and angularity of the orange belt across the primaries combined with the sharply defined and perfectly straight inner edge of this belt from subcostal vein to first median branch.

16. *Ixias frequens*.

Ixias frequens, Butler, P. Z. S. 1880, p. 150, pl. xv. figs. 6, 7.

Ixias alana, Swinhoe, Ann. & Mag. Nat. Hist. ser. 6, vol. v. p. 357 (1890).

India generally. B. M.

Thirty-three examples, representing wet-, intermediate-, and dry-season forms; the males and sometimes the females of the dry form are smaller and with much narrower (though always well-marked) border to the upper surface of the secondaries.

17. *Ixias moulmeinensis*.

Ixias moulmeinensis, Moore, P. Z. S. 1878, p. 837.

Ixias meipona, Grose-Smith, Ann. & Mag. Nat. Hist. ser. 5, vol. xix. p. 296 (1887); Rhop. Exot., *Pieris* II., *Ixias*, figs. 4, 5 (1888).

Burmah. B. M.

We have thirty-three examples, representing wet-, intermediate-, and dry-season forms; the wet form is *I. meipona* and the dry *I. moulmeinensis*. Doubtless this is the Burmese representative of the Indian *I. frequens*; as a whole it is somewhat smaller (though individuals of the same size belonging to both species may be selected from a long series), the orange belt of the primaries is more golden, more deeply incised at the end of the cell, and, in the female, where it becomes an orange or yellow band, it is more narrowly bordered behind with black; the border of the secondaries is much narrower, almost disappearing in the extreme dry form, which is also much more heavily and clearly marked with ocelloid spots on the under surface than in *I. frequens*.

18. *Ixias dharmsalæ*.

Ixias dharmsalæ, Butler, P. Z. S. 1880, p. 150, pl. xv. figs. 8, 9.

Ixias ganduca, Moore, Journ. As. Soc. Beng. lit. p. 44 (1884).

Ixias colaba, Swinhoe, P. Z. S. 1885, p. 142, pl. ix. fig. 6.

India, from Darjiling to the Western Provinces and southwards to the Neilgherries.

Twenty-eight specimens are in the collection and one in the Hewitson cabinet. *I. colaba* is the wet-season form, *I. dharmsalæ* a dry form (probably occurring at the commencement of the dry season), and *I. ganduca* the extreme dry form.

This butterfly can be distinguished from *I. frequens* by its narrower, internally notched, and more or less macular hindwing outer border, which also tapers less towards anal angle, and in the possession of an additional form of female (wholly black and white above). I am doubtful whether it will be possible to keep it distinct from *I. pirenassa* (of which no wet form answering to the type is known to me).

19. *Ixias satadra*.

Ixias satadra, Moore, Ann. & Mag. Nat. Hist. vol. xx. p. 50 (1877);

Waterhouse, Aid. ii. pl. cxxviii. fig. 1 (1883).

Ixias Watti, Butler, P. Z. S. 1880, p. 151, pl. xv. fig. 1.

Ixias pygmæa, Moore, P. Z. S. 1882, p. 254, pl. xii. fig. 1.

Northern India from Sikhim to Campbellpore. Fourteen examples. B. M.

The type of the species is an intermediate-season form, but so little marked below that it probably occurs at the end of the wet season. We also have two dry forms, the first occurring probably at the commencement of the dry season and the other (which is more extreme in its seasonal characters) a little later; the latter is *I. pygmaea*. This species is characterized by the very irregular and somewhat narrow orange belt on the primaries of the male, the macular and rapidly tapering form of the blackish border to the secondaries; the dry-season female varies very little in colour, the subapical belt on the primaries being sulphur-yellow, sometimes feebly washed with orange.

20. *Ixias pirenassa*.

Thestias pirenassa, Wallace, Trans. Ent. Soc. ser. 3, vol. iv. p. 395, pl. ix. fig. 4, ♂ (1867).

Ixias kausala, Moore, Ann. & Mag. Nat. Hist. ser. 4, vol. xx. p. 49 (1877).

Ixias jhoda, Swinhoe, P. Z. S. 1885, p. 142, pl. ix. figs. 3, 4.

Western India southwards to Depalpur. Twenty-eight specimens. B. M.

It is quite possible that this may only be represented by dry phases of *I. dharmsalæ*; *I. pirenassa*, *I. jhoda*, and *I. kausala* representing three grades, of which the last-mentioned is the most pronounced dry form. We have four intermediate-seasonal specimens, one of which, in the pattern of the upper surface, links typical *I. pirenassa* to *I. jhoda*, whilst the three others show the upper-surface pattern of *I. jhoda* and the size of *I. kausala*.

The only objection to sinking *I. dharmsalæ* under *I. pirenassa* is that we should have to admit great instability in the seasonal modification of the hind-wing border (some of the examples obtained just after the rains showing a drier character of upper surface than those of the dry season), and we should also be compelled to recognize five grades of dryness in the under-surface pattern. On the whole I prefer to await further evidence before assuming that the forms of the *I. pyrene* section of my group 3 are more variable than those of the *I. evippe* section.

21. *Ixias sesia*.

Papilio sesia, Fabricius, Gen. Ins. p. 257 (1777); Donovan, Ins. China, pl. xxxi. fig. 2 (1798).

Burmah. Nineteen examples. B. M.

All the specimens that I have seen, including four in the

Hewitson cabinet, have a more or less dry-season character of under surface, but the character of the upper surface varies from wet to dry, as in the seasonal forms of the *I. marianne* group. The female invariably has the inner edging of the orange belt on the primaries widely interrupted in the centre, and the driest examples of the males have this blackish border reduced in the centre to a mere dusted line; the black discocellular spot on the primaries is almost invariably isolated from this black edging, owing to the continuation of the orange belt to a short distance inside of it. The late Capt. Watson regarded this last as a character of almost specific importance, but it is certainly not quite constant and therefore is of no great value.

It is, of course, just possible that *I. sesia* may be based upon additional variations of the dry form of *I. moulmeinensis*; but then we should have more difficulties to contend with than in the case of *I. pirenassa* as representing phases of *I. dharmalæ*. I think it far more likely that, as in *I. marianne*, several of these allies of *I. pyrene* invariably show dry-season characters on the under surface which are merely intensified in the dry season, whereas the bordering of the secondaries above varies in width seasonally.

22. *Ixias pyrene*.

Papilio pyrene, Linn. Mus. Lud. Ulr. p. 241 (1764); Cramer, Pap. Exot. ii. pl. cxxii. figs. A, B (1779).

♀. *Papilio ænippe*, Cramer, Pap. Exot. ii. pl. cv. C, D (1779).

China. Twelve examples. B. M.

I have very little doubt that Cramer's figures of *P. pyrene* (A and B) represent the wet-season form, though showing dry-season characters on the underside. The species is nearly related to *I. sesia* and possibly not distinct from it, as Donovan's illustration of *I. sesia* is probably taken from a Chinese example; the dry form of China, however, which is typical *I. pyrene*, is decidedly larger than that of Burmah. The locality "America" given by Fabricius affords no clue to the real habitat of his type.

Group 4. (Type *I. Ludekingii*.)

Chiefly differs from the preceding group in the nearly white wings of both sexes. The seasonal differences are quite normal, only the dry form having the wings ocellated below.

23. *Ixias andamana*.

Ixias andamana, Moore, P. Z. S. 1877, p. 590.

Ixias lena, Swinhoe, Ann. & Mag. Nat. Hist. ser. 6, vol. v. p. 357 (1890).

Andamans. Twenty-two examples. B. M.

I. andamana was based upon the intermediate and *I. lena* on the dry form.

24. *Ixias Ludekingii*.

Thestias Ludekingii, Vollenhoven, Monog. Pier. p. 49, pl. v. fig. 6 (1865); Tijd. Ent. iii. p. 126 (1869).

Sumatra. ♂ from G. and S. coll. B. M.

Our single example belongs to the wet-season form, but the type was a dry form. We have what I believe to be the male intermediate form from Salanga.

25. *Ixias pallida*.

Ixias pallida, Moore, P. Z. S. 1878, p. 837.

Ixias citrina, Moore, l. c.

Tenasserim. Seven examples. B. M.

I. pallida was based upon a wet-season male, *I. citrina* upon a dry-season male.

26. *Ixias verna*.

Ixias verna, Druce, P. Z. S. 1874, p. 108, pl. xvi. figs. 5, 6.

Ixias latifasciatus ♀, Butler, P. Z. S. 1871, p. 252, pl. xix. fig. 3.

Burmah, High Island, Mergui. B. M.

We have fifteen examples, seven of which (including the types of the species) were presented by Messrs. Godman and Salvin. *I. latifasciatus* was figured from an intermediate female, *I. verna* was described from a dry-season pair. A male from Mergui in the collection may perhaps be a curious aberration of this species.

Group 5. (Type *I. marianne*.)

I am quite satisfied that the late Capt. Watson was correct in his view of the species of this group; all the seasonal forms show ocellated markings on the under surface, but they become emphasized in the dry season, whilst the black belt across the primaries on the upper surface and the black border to the secondaries are reduced.

27. *Ixias marianne*.

Papilio marianne, Cramer, Pap. Exot. iii. pl. ccxvii. C-E (1782).

Ixias bebruce, Hubner, Verz. bek. Schmett. p. 95 (1816).

Ixias agnivera, Moore, Ann. & Mag. Nat. Hist. ser. 4, vol. xx. p. 50 (1877).

Ixias depalpura, Butler, P. Z. S. 1883, p. 153, pl. xxiv. figs. 6, 7.

Ixias meridionalis, Swinhoe, P. Z. S. 1885, p. 140, pl. ix. fig. 5.

Ixias cumballa, Swinhoe, t. c. p. 141, pl. ix. figs. 13, 14.

We have twenty-five examples of the wet-season form (*I. cumballa*), thirteen of the intermediate form (*I. marianne*), twenty-three of the early dry form (*I. meridionalis*), and sixteen of the late dry form (*I. agnivera*=*depalpura*)—seventy-seven examples in all.

28. *Ixias nola*.

Ixias nola, Swinhoe, P. Z. S. 1889, p. 399.

Mahableshwar. Twelve examples. B. M.

The seasonal forms are all represented in our series; a pair of the wet and a pair of the dry form are equally labelled as types.

XXIII.—On a Precaudal Vertebra of *Ichthyosaurus australis*,
McCoy. By R. ETHERIDGE, Jun., Curator*.

THE subject of this paper is the imperfect vertebra of a large Ichthyopterigian, referable, I believe, to *Ichthyosaurus australis*, McCoy †. The original was brought under my notice by the Rev. M. Kirkpatrick, of Bega, N. S. Wales, who obtained it from Marathon, Central Queensland. With his permission a cast was taken for the Australian Museum collection. As Sir F. McCoy's description was very brief, an extended notice of one of the middle trunk, or anterior precaudal, vertebræ may be acceptable to Australian investigators.

The specimen is the centrum of a large vertebra measuring 5 inches in its vertical and transverse diameters, and rivals in size those of the gigantic *I. campylodon*, Carter, from the European Chalk, the vertebra figured ‡ by the late Sir Richard Owen measuring only 4 inches high. Our example is devoid of the neural spine, neurapophyses, and pleurapophyses, but

* From the 'Records of the Australian Museum,' vol. iii. no. 3 pp. 66-68.

† Trans. Roy. Soc. Vict. viii. 1868, p. 41.

‡ Owen, Mon. Foss. Reptilia Cret. Formation, p. 79, pl. xxii.

having the articular surfaces of the first and last well displayed. The positions of the diapophysial and pleurapophysial articular surfaces leads to the belief that the vertebra is one of the middle trunk series. It is subcircular in outline, slightly narrowed and contracted neurally. Measured across the articular surfaces from the neural to the hæmal margins the diameter is exactly 5 inches, and in a transverse direction from diapophysis to diapophysis it is an eighth of an inch short of a similar measurement. Longitudinally measured between the dia- and pleurapophysial tubercles the centrum is exactly 2 inches, but on the hæmal surface it is a quarter of an inch more.

The concave terminal articular surface visible is deep, terminating in a central fossa, the extent of the concavity being well exemplified by the matrix cast of the anterior cavity of the succeeding vertebræ at the posterior end of this specimen. This mass of matrix represents the "elastic capsule" that intervened between the vertebræ, and retains on its surface portions of the osseous tissue of the succeeding centrum. The periphery or immediate articular rim at each end is narrow, the surface thence sloping rapidly inwards, but the edges of the rims project slightly outwards, thus rendering the longitudinal or lateral surfaces of the centrum somewhat concave. The depth of the concavities is an inch, or perhaps a little more, and a longitudinal section of the centrum would be, in consequence, of a strongly hour-glass-shaped outline. The floor of the myelonal canal is $\frac{3}{4}$ of an inch wide, the joint-faces of the neurapophysial surfaces rather triangular on very strongly raised fore and aft synchondrosial articular elevations; the space between these and the diapophysial tubercles is roughly 3 inches, the latter having descended in close contiguity to the parapophysial tubercles. It is clear, therefore, that this vertebra, from the wide disassociation of the neura- and diapophyses, occupied a position in the column certainly more than one third of the trunk from the head, and, according to Owen's measurements, was near about the forty to forty-fifth vertebra, for in this region in *Ichthyosaurus* the dia- and parapophyses form a pair of separate tubercles on each side near the anterior end of the centrum.

The diapophyses are set further in from the anterior articular edge than the parapophyses; these are close to the latter, but are not connected with it by a "neck." Both are represented by large and strong rounded tubercles, separated from one another by an interval of two-eighths of an inch, this interstitial surface being deep and groove-like. The hæmal surface is quite plain.

The posterior concave articular surface is infilled with matrix, affording a complete cast of the next succeeding anterior cup, and even retaining a portion of the osseous tissue of the latter adhering to it. This tissue throughout the centrum is well preserved and dense.

The specimen is certainly of the *Campylodont* group of *Ichthyosauri*, and occupies an intermediate position in outline between an "early posterior dorsal" and a "late posterior dorsal" vertebra of *I. trigonus*, Owen*.

The largest *Ichthyosauri* attained a length of from 30 to 40 feet, and the present meridional species was in no way inferior to its gigantic fellows of the European Secondary seas. If we apply a similar method of arriving at the comparative size of an *Ichthyosaurus* as that adopted by Prof. Owen—that the jaw was "thirteen times the length of the vertical diameter of an abdominal or anterior caudal centrum"—we see in the present fossil the representative of an animal possessing a jaw a little over 5 feet in length—thus, $13 \times 5'' = 65'' = 5' 5''$ long. Prof. McCoy computed † the remains of his type specimen to represent an animal 25 feet long. Similar vertebræ to that now described he states possessed a diameter of 4 inches, and elsewhere he remarks ‡ that the longitudinal measurement reached $1\frac{1}{2}$ inch. The elastic capsule was also preserved in some of his specimens.

Mr. R. Lydekker, in the previously mentioned 'Catalogue,' gives a list of species that "cannot be classified" §. Amongst these are *I. australis*, McCoy, and *I. marathonsensis*, mihi. I am afraid he has overlooked Sir Frederick's principal paper on his *I. australis*, wherein, although the description is meagre, the latter specially compares the teeth of his fossil to those of *I. campylodon*, and says they "have a rough bony square base like those of *I. campylodon* (Carter)." As regards *I. marathonsensis*, mihi, less can perhaps be definitely said; but the whole of its structure, so far as we know it, is also after the type of *I. campylodon*. In my paper on this fossil I called attention to the necessity of affording another name to *I. australis*, Hector, a New Zealand species distinct from McCoy's. This has now been done by Mr. Lydekker terming it *I. Hectori* ||; but unfortunately the species is of no value, from the absence of either description or figure, all

* Lydekker, Brit. Mus. Cat. Foss. Reptilia and Amphibia, 1839, pt. 2, p. 26, figs. 13 and 14.

† Trans. Roy. Soc. Vict. ix. 2, 1869, p. 77.

‡ Ann. & Mag. Nat. Hist. (3) xix. 1867, p. 355.

§ Loc. cit. p. 113.

|| Loc. cit. p. 113.

that Sir James Hector says about it being "this genus is only represented in the collection by a single vertebral centrum."

Ichthyosaurus indicus, Lyd.*, seems to be an allied species to *I. australis*, and also vied with *I. campylodon* in size. It is from the Ootatoor Group, the homotaxial equivalent of the Chalk Marl and Upper Greensand of England.

McCoy's original specimens were from Walker's Table Mountain on the Flinders River. The present vertebra is, as before said, from Marathon on the same stream. Both are localities in the Rolling Downs Formation, or Lower Cretaceous.

XXIV.—*Description of some new Species of Heterocera.*

By HERBERT DRUCE, F.L.S. &c.

Fam. Syntomidæ.

Syntomis cærulescens, sp. n.

Female.—Primaries black, with six hyaline white spots—the first close to the base, the second at the end of the cell, the third below the second slightly nearer the base, the other three spots forming a band nearer the apex, the middle spot being the smallest: secondaries black, with two hyaline white spots, the first close to the base and extending to the inner margin, the second smaller and nearer the apex. The fringe of the primaries black, with a small white patch at the apex and near the anal angle. Antennæ black, with the tips white; the head, thorax, and abdomen bluish black; the front of the head white; the tegulæ black, with a small white dot at the base; abdomen banded with white at the base; the legs bluish black.

Expanse $1\frac{1}{4}$ inch.

Hab. East Africa, Delagoa Bay (*Monteiro, Mus. Druce*).

Two specimens.

Syntomis brithyris, sp. n.

Female.—Primaries smoky black, with two hyaline spots along the costal margin, the first at the end of the cell, the second beyond near the apex, below which is a large pale yellow spot; a small hyaline streak near the base, on the lower side of which is a rather wide curved yellow band that extends from the base almost to the anal angle: secondaries

* Pal. Indica (4) i. 3, 1879, p. 27.

smoky black, the base and a spot beyond pale yellow. Antennæ black, tipped with yellow; the head and thorax pale yellow; the tegulæ black, with yellow base; abdomen black, banded with pale yellow.

Expanse $1\frac{3}{4}$ inch.

Hab. N.E. Borneo (*Pryer, Mus. Druce*).

Syntomis discata, sp. n.

Female.—Primaries hyaline, slightly yellowish at the base; a large spot at the end of the cell, the apex, a spot at the anal angle, and the inner margin all black; secondaries yellowish hyaline, the outer half of the wing black. The head, antennæ, and thorax black; the collar, tegulæ, and abdomen orange-yellow, the anal segments of the abdomen black; legs black.

Expanse $1\frac{1}{10}$ inch.

Hab. East Africa, Dar-es-Salaam (*Mus. Druce*).

Hyalæthæa metaphæa, sp. n.

Female.—Primaries hyaline; the costal margin, apex, outer and inner margin black; a wide black streak extends from the end of the cell to the outer margin, and a second black streak from the side of the cell to the anal angle: secondaries hyaline, edged with black. The head, thorax, and abdomen black; the front of the head, tegulæ, and base of the abdomen yellow; legs black.

Expanse $1\frac{1}{2}$ inch.

Hab. Aola, Guadalcanar Island, Solomon group (*C. M. Woodford, Mus. Druce*).

Agaphthora puncta, sp. n.

Male.—Primaries yellowish hyaline; the costal margin, apex, outer and inner margin black; the veins and a wide band crossing the wing from the end of the cell to the anal angle black: secondaries black, with a hyaline spot close to the base: the fringes of both wings black. The head, antennæ, thorax, abdomen, and legs black; the tegulæ white at the base; the abdomen spotted with white on each side and down the middle.

Expanse $1\frac{1}{4}$ inch.

Hab. New Guinea, Humboldt Bay (*W. Doherty, Mus. Druce*).

Zatrephes Garleppi, sp. n.

Primaries very similar to *Z. Buckleyi*, but red instead of yellow, and with a large lead-coloured mark at the anal angle: secondaries semihyaline red, darkest at the apex and along the inner margin. The head, thorax, and abdomen bright red, the collar edged with white. The underside of the head, thorax, antennæ, and legs black.

Expanse 2 inches.

Hab. Bolivia (*Mus. Druce*).

This fine species is allied to *Z. Buckleyi* from Ecuador.

Fam. Arctiidæ.

Antarctia ubiana, sp. n.

Male.—Primaries pale brown, darkest along the costal margin, and an indistinct darker brown spot at the end of the cell; the fringe brown: secondaries pale brown, shaded with yellow at the base and along the inner margin to the anal angle; the fringe pale yellowish brown. Head, thorax, and tegulæ dark brown; antennæ black; abdomen yellow.—*Female* very similar to the male, but larger and rather paler in colour.

Expanse, ♂ $1\frac{1}{2}$ inch.

Hab. Panama, Chiriqui (*Mus. Druce*).

This species is allied to *A. rudis*, Butl.

Fam. Notodontidæ.

Nystalea arecosa, sp. n.

Male.—Primaries brownish grey, crossed near the base from the costal to the inner margin by a rather wide brown band, which becomes much paler near the inner margin, and with three small brown spots on the costal margin and a large brown patch near the apex, below which is a smaller brown spot, the outer margin at the apex edged with brown: secondaries greyish white, clouded with brown from the apex to the anal angle, the fringe greyish white. The underside of both wings white, shaded with reddish brown along the costal margins. Head, antennæ, thorax, and basal half of the abdomen greyish brown, the rest of the abdomen greyish white.

Expanse $1\frac{3}{4}$ inch.

Hab. Panama, Chiriqui (*Trötsch, in Mus. Staudinger*).

Fam. Geometridæ.

Milionia regina, sp. n.

Male.—Primaries very similar to the primaries of *M. Meeki*, but with the red band from the base very much narrower: secondaries deep black, the outer margin from the apex to the anal angle edged with a narrow band of chrome-yellow, upon which are six round black spots. Head and front of thorax blue-black; thorax and anal tuft chrome-yellow; abdomen bright blue.

Expanse $2\frac{3}{4}$ inches.

Hab. Woodlark Island (*Mus. Druce*).

Fam. Thyrididæ.

Rhodoneura now, sp. n.

Male.—Primaries and secondaries black; both wings with a central faint greyish line across the middle. Underside of both wings reddish brown, streaked with black. The head, antennæ, thorax, and abdomen black; the underside of the abdomen pale fawn-colour; the legs dark brown.

Expanse 1 inch.

Hab. Tenasserim Valley, Burmah (*Doherty, Mus. Druce*).

XXV.—*On the Hares of Western Europe and North Africa.*
By W. E. DE WINTON.

FOR some time it has been evident that among the hares in the collection of the British Museum from different points in Southern Europe and the northern coast of Africa several species were represented, but until quite lately specimens were wanting from Sardinia, the type locality of *Lepus mediterraneus*, Wagner, and from Tangier, the type locality of *L. Schlumbergeri*, St. Loup, so that it was impossible to classify them satisfactorily; these two desiderata being now supplied, the authorities have kindly allowed me to work out this group.

Very little attention has been paid to the hares of Europe since 1857, when Blasius wrote his 'Fauna wirb. Deutschlands, Säug.,' a book which still stands far ahead of any other work on European mammals; this author seems to have had the necessary material to have thrown more light

upon the various forms of South European hares, but it does not seem quite clear that he had actually compared specimens from Spain with typical specimens of *L. mediterraneus*, Wagn., which he had seen in Turin (*t. c.* p. 415).

It is now generally agreed that Linnæus's *Lepus timidus* refers to the blue or variable hare, so that *L. europæus*, Pallas, must stand as the name of the brown hare; thus the typical form of that species is the brown hare of Russia = *L. timidus* (form *c*) of Blasius (*t. c.* p. 417). The Western European form described by Blasius (form *b*) as differing in colour is also smaller, the length of the hind foot being about an inch shorter than that of the Russian hare; although Blasius recognized the difference, he does not attach any distinguishing name to the form, but a name is placed in the synonymy attributed to Schimper on the authority of Gervais (*Zool. et Paléont. Fr.* p. 29, 1851), to which no description was ever published. In describing the species from the Mediterranean region these more northern well-known forms had to be referred to, and the Central or Western European form being found to differ so much in size and colour from the typical *L. europæus*, it is considered necessary to describe it and give it a distinguishing sub-specific name.

On bringing together specimens from the different countries bordering the northern and southern shores of the western portion of the Mediterranean Sea, it will be found that they form a very miscellaneous group. In choosing names for the different forms described I endeavoured to employ several that have found their way into the synonymy given by most authors of *L. europæus*, so that, in fact, hares should be found to fit the names, and not fresh names invented: but this was not found possible, the majority evidently referring to the same species; therefore to save further confusion fresh names are used.

The name *Lepus mediterraneus* was given by Wagner (*Münch. Anz.* 1841, p. 439) to the small species occurring in the island of Sardinia; this name has usually been employed by modern authors when mentioning hares found in any of the adjacent countries. Gervais (*Zool. et Paléont. Fr.* p. 29, 1851) introduced two names on the authority of Schimper, who had got together a considerable number of hares in the Strassburg Museum, the conclusion being that these forms were the same as *L. meridionalis*, Gené, a name never published; but later (*Hist. Nat. Mamm. i.* p. 282, 1854) the same author considers that Gené's species might probably be identical with *L. mediterraneus*, Wagn. Schimper appears

never to have published the results of his investigations himself. Blasius (Faun. Deutschl., Säug. p. 412, 1857) mentions all these names as synonyms of *L. timidus* = *L. europæus*, and brings in another name attributed to Schimper (Regensb. Corresp. 1850, p. 111), proposed for the hare of Andalusia obtained by Dr. Rosenhauer, but to which no description was added. Fitzinger (Sitzb. d. k. Akad. Wissensch. 1867, p. 161) adds another name for the Pyrenean hare (?sp.) on the authority of Nérée Boubée, with no reference to any description, but simply as a synonym of *L. timidus* = *L. europæus*; the same author in the same place introduces a name for the hare of Andalusia on the authority of Natterer, also without reference to it ever having been previously published: Natterer certainly was the first author to distinguish this hare from those of Central Europe; but although he gives a short description ('Isis,' 1818, col. 816), he mentioned no name, and Fitzinger does not notice this reference; it must therefore be written off as a *nomen nudum*. One more name for this same hare, though never published, is still in existence in the Vienna Museum; one or more specimens from Andalusia are, or were, labelled "*Lepus gracilis*, Natt." For this last piece of information I am indebted to Mr. Oldfield Thomas, who noted the fact during a visit to that museum in 1877.

Waterhouse (Mamm. vol. ii. p. 43, 1848) complicated matters by taking a hare from Tunis as typical of *L. mediterraneus*, Wagn.; but no specimen from Sardinia was then in the British Museum for comparison, so the error may readily be excused.

In this paper a deviation is made from the rule as to taking measurements; in all cases the length of the ear is taken from the base at the back, and not from the notch unless particularly stated. Every effort has been made to give as full measurements of the skulls as possible; but as there is so much individual variation, and the character of the skulls in this group makes it so difficult to know where to fix the points of the compass, owing to the irregularity of the sutures and many apophyses, these measurements must be accepted for what they are worth. Greatest length of nasal bones is taken diagonally on the bone of one side, being far easier than between two parallels, as there are no points in strict longitudinal line. The "molar series" is measured by the outsides of the tooth-sockets, as it is considered more reliable in this group than the teeth, which slope and have no crowns.

Lepus europæus occidentalis, subsp. n.

Smaller than *L. europæus typicus*; colour much warmer and more rufous throughout.

The difference in the length of the hind foot is perhaps the most constant size character. The difference in colour is most constant in the head and ears and legs.

I take as the type of this subspecies a specimen from Herefordshire, killed on the 7th January, 1898, which I propose to present to the British Museum.

Measurements taken in the flesh :—

Head and body 570 millim.; tail 86; hind foot 135, to end of claws and hair 142; ear from notch 99, from base at back 120.

Weight when killed 8 lbs. 6 oz.

For comparison I give measurements of a Russian hare of quite ordinary proportions (no. 94. 8. 7. 30 in Brit. Mus.), from Lithuania :—

Head and body (dry skin) (c.) 600 millim.; tail (c.) 90; hind foot (c.) 156, to end of claws 168; ear from notch (c.) 110, from base at back (c.) 121 without end-hairs.

The comparative measurements of the skulls given below do not show any striking differences, excepting in the basal length and mandible; I am, however, unable to say if this greater length would be always found in the Russian hare, but the proportion seems constant in the specimens examined.

Skull :	<i>L. e. typicus.</i> <i>L. e. occidentalis.</i>	
	millim.	millim.
Greatest length	102	99·5
„ breadth	48	47
Breadth across maxillæ below lachrymals	39·5	35·5
Nasals, length in middle line	36	38·5
„ greatest length	48·5	46·5
„ greatest breadth	26	23
„ across narrowest part	18·5	17
Intertemporal constriction	14·7	15
Basal length	85	79·7
Length of upper molar series	20·5	20
Depth from top of nasals to palate in front of premolars	26	26
Depth from top of nasals to front of palate	20·5	21
Mandible, length (bone only) from condylar process to upperside of incisors	79·5	72
Mandible, length from back of incisors to angle	76	67
Mandible, greatest height standing on table perpendicularly to condyle ..	46·5	41

Lepus Lilfordi, sp. n.

Lepus granatensis (Schimp.), Rosenhauer, Regensb. Corresp. 1850, p. 111 (nom. nud.).

Lepus meridionalis (Gené), Gervais, Zool. et Paléont. Fr. p. 29 (1851) (partim, n. n.).

Lepus hispanicus (Natt.), Fitzing. Sitzb. Ak. Wissensch. 1867, p. 161 (n. n.).

Lepus pyrenaicus (Boubée), Fitzing, t. c. (n. n.).

Lepus gracilis, Natt., MS., in Museo Viennense (n. n.).

Lepus timidus (partim), Blasius et auct.

Lepus europæus (partim), *Lepus mediterraneus* (partim), auct.

Upper parts of head and body, ears, and tail much as in *L. e. occidentalis*, though the colours are darker, while varying somewhat in tone, as in that species; the tail is long, black above, white on the sides and beneath. Fur very much waved or plaited on the back; interspersed among the ordinary fur are long, coarse, snow-white hairs, which are very much more conspicuous than in *L. e. occidentalis*, especially on the sides and rump; these long hairs in their basal half, or that part hidden by the thick fur, are black, the terminal half protruding beyond the fur snow-white; both fore and hind limbs bay-red in front, snow-white behind; the white almost encircling the fore leg immediately above the elbow, and at the wrist extending from the inner side round on to the front of the joint; the fore feet are red, with tips near the nails white; on the hind feet the white extends in the same way from the inner side of the heel, so that the front of the foot is white save for the presence of narrow lines between the toes. The whole of the underparts are snow-white excepting the neck-band, which is dark fawn.

The most striking character of this hare is the sharp distinction between the colours of the upper and under surfaces of the body and the strong contrast between the bright bay of the outer sides of the legs and the pure white of the inner sides, the fur being also sleeker and lying closer on the legs than in any other species.

In the seven specimens referred to there is no variation whatever in the character of the markings.

Type ♂, 2nd Dec. 1894, Seville (Brit. Mus. no. 95. 3. 3. 12). Presented by Lord Lilford.

Measurements (taken from dried skin):—

Head and body 470 millim.; tail 86; ear 118; hind foot (without claw) 116.

Skull: greatest length 89; greatest breadth 43; breadth across maxillæ below lachrymals 33; length of nasals in middle line 30, greatest length 38, greatest breadth 20, across narrowest part 15.5; intertemp. constr. 12.1; basal length 71.5; length of upper molar series (tooth-sockets) 16.9;

depth from top of nasals to palate immediately in front of premolars 22·5, in front of palate 20; mandible, length (bone only) from condylar proc. to upperside of incisors 65, back of incisors to angle 60·5; greatest height standing on table perpendicularly to condyle 38·3.

The number of names which have been proposed show clearly that this hare was never thought to be the same as the more northern form, and I can only suppose that the would-be describers were baulked by not having a typical *L. mediterraneus* for comparison. It seems perfectly incredible that this well-marked species, by far the most strikingly coloured member of the genus, should never have been described; but after a most thorough search in every book or pamphlet which was likely to throw light on the subject, I am unable to attach any of the above names to a description.

I have connected with this handsome species the name of the late Lord Lilford, in memory of the extreme interest he took in the mammals of Europe, especially those of the Spanish peninsula, and in recognition of the gracious help he was always ready to give in assisting this branch of zoology.

Lepus mediterraneus, Wagn.

Lepus mediterraneus, Wagner, Münch. Anz. 1841, p. 489 (nec Waterhouse, nec Loche).

A description of this hare is given here for the sake of comparison, especially in regard to the measurements of the skull.

Size very small, not much more than half that of *L. e. occidentalis*; the ears are rather short in proportion, the backs of which are thinly clad with hair; the fur of the back is not waved and plaited; the nape, fore and hind legs bright foxy red, the underparts strongly washed with the same colour, excepting the centre of the belly and the inguinal region, which are pure white; there are no sharp lines between the colours in any part excepting the tail, which is like its allies. The bases of the fur in all parts are slate-coloured; this is very marked in the neck and chest-band, and on the back the fur is buff-grey beneath the broad black ring, and not white as in *L. europæus* and allies.

Measurements (taken from dried skin, no. 92. 2. 27. 1, in the British Museum, from Sardinia):—

Head and body (c.) 400 millim.; tail 76; hind foot 97; ear 96.

Skull: greatest length 79·5; greatest breadth 39; breadth of maxillæ below lachrymal 27·5; length of nasals in middle line 27, greatest length 34, greatest breadth 17·5, across narrowest part 12; intertemp. constr. 12; basal length 63; length of upper

molar series (tooth-sockets) 15; depth from upperside of nasals to palate immediately in front of premolars 18·5, above front of palatal foramen 16; mandible, length (bone only) from back of condylar process to upperside of back of incisors 57·3, from angular process to same place 55; greatest height standing on table perpendicularly to condyle 31.

Lepus corsicanus, sp. n.

In general colouring and proportions very similar to *L. e. occidentalis*, but resembling *L. mediterraneus* in having deeper grey bases to the fur generally, and the fur of the back being rusty below the black ring, with grey bases. The eyering is very conspicuous, being shown up by a rufous patch on the cheeks, which extends from in front of the orbit to halfway between the eye and ear. This pattern is traceable in other species, but is not nearly so conspicuous. The nape of the neck is unlike any of its allies, being grizzled smoky grey.

Type ♂, January 1875, Bastia (Brit. Mus. no. 78. 7. 3. 4). Presented by Lord Lilford.

Measurements (taken from dry skin):—

Head and body 450 millim.; tail 73; hind foot 119; ear 107.

Skull: greatest length 90; greatest breadth 43·5; breadth of maxillæ below lachrymals 31·2; length of nasals, middle line 31·5, greatest length 39·5, greatest breadth 21·5, narrowest part 14; intertemp. constr. 15; basal length (c.) 73; length of upper molar series (tooth-sockets) 17·2; depth from top of nasals to palate in front of premolars 21·5, at front of palatal foramina 18·2; mandible, length (bone only) from back of condylar process to upperside of back of incisors 65, upperside of back of incisors to angle 59·5; greatest height standing on table perpendicularly to condyle 36·5.

The breadth of the skull will at once distinguish this form from its near ally *L. kabylicus*.

Lepus kabylicus, sp. n.

Lepus mediterraneus, Levaill. Loche's Expl. Alg., Mamm. sp. 84 (nec Wagn.).

Lepus ægyptius, Lataste, Act. Soc. Linn. Bordeaux, xxxix. p. 157 (nec Geoff.).

Size about that of *L. Lilfordi*, but in colour closely resembling *L. mediterraneus*; the ears, which are still more naked behind than in the latter species, are proportionately longer, as are also the hind feet, and, like that species, the base of the fur is slate-coloured, and on the back the fur is

not white below the deep black ring, but buff shading into grey. There is a conspicuous buff-white ring round the eyes extending towards the nose and ears. The chest (somewhat grizzled) and fore legs are rufous, and all the underparts except the centre of the belly and the inguinal region are much washed with the same colour.

Type (Brit. Mus. no. 51. 8. 25. 7), Algiers.

Measurements (taken from dry skin):—

Head and body 475 millim.; tail (taken from another specimen, that of the type injured) 80; hind foot (c.) 105; ear 113.

Skull: greatest length, base damaged (c.) 86; greatest breadth 41; breadth of maxillæ below lachrymals 28.5; length of nasals, middle line 27, greatest length 34.5, greatest breadth 20, narrowest part 12.5; intertemp. constr. 12.2; basal length —; length of upper molar series (tooth-sockets) 15; depth from top of nasals to palate immediately in front of premolars 20.2, at front of palatal foramina 17.2; mandible, length (bone only) from back of condylar process to upperside of back of incisors 62, upperside of back of incisors to angle —; greatest height standing on table perpendicularly to condyle 35.5.

This hare is no doubt closely allied to *L. mediterraneus*, but, besides the greater size of the animal, the skull is so peculiarly narrow, that I consider it worthy of full specific rank.

Lepus Schlumbergeri, St. Loup.

Lepus Schlumbergeri, St. Loup, Bull. Soc. Zool. France, 1894, t. xix. p. 168.

As this hare has been very imperfectly described, a more complete description is here given; it is the common hare in the neighbourhood of Tangier.

Size medium, rather smaller than *L. e. occidentalis*; darker and grayer in colour, somewhat resembling the East African hare *L. victoriae*, but the grizzling coarser and more mottled owing to the very broad black median band on the fur; nape very pale cinnamon; a well-defined buff-white ring round the eyes, a stripe of the same colour extending towards the nose and the ears; ears medium, about same length as head, black tip not well defined; neck and chest dull brown, grizzled. The extreme bases of the fur of all parts are pale grey, on the back the base of the fur is only very faintly tinged with grey; there is a broad extent of dirty white, showing a slight tinge of pale cinnamon, followed by a deep black band; above this the coarser glossy hairs have

a broad pale buff ring, the extreme tips black. Whiskers scarce, mostly white.

Measurements :—

Head and body 470 millim.; tail (c.) 75; hind foot 120; ear 103, from occiput 115.

Skull : greatest length 91; greatest breadth (squamosals) 42·5; breadth across front of zygomata 41·5; length of nasals in the middle line 31, greatest length 40, greatest breadth 21, across narrowest part 14·5; intertemp. constr. 12, breadth across maxillæ below lachrymals 31·7; basal length 72·5; length of upper molar series 15; depth from nasals to palate immediately in front of molars 20, above front of palatal foramina 16·5; length of mandible (bone only) from back of condylar process to upperside of back of incisors 65·5; greatest height standing on table perpendicularly to condyle 37·5.

Supraorbital wings well developed, prominently rising above frontals; temporal constriction very narrow; nasals very broad, encroached upon considerably by the frontals, in a broad almost parallel-sided process.

The skull is very broad, with prominent supraorbital wings, and thus very unlike the Algerian hare *L. kabylicus* (*suprà*) in every particular.

Lepus tunetæ, sp. n.

Lepus mediterraneus, Waterhouse, Mamm. ii. p. 43, 1848 (nec Wagn.).

In texture of fur and in the length of the ears resembling *L. ægyptius*, but the plain grooves in the incisors without cement-filling show it to be widely separated from that species. Colour pale, rather sandy; nape of neck soft reddish fawn; fore and hind legs reddish fawn; belly white; tail black above, white below. Colours generally dull and not sharply defined. Ears very long, almost naked behind in their whole length.

This is the hare taken by Waterhouse for *L. mediterraneus*, and from the extreme smallness of the last molar that naturalist was led to suppose that the tooth was altogether wanting; but it need hardly be said that this is *not* the case. This small tooth is only about half the size of that tooth in true *L. mediterraneus*, and, pressing closely against $\frac{m}{2}$, it might be overlooked if the skull was not thoroughly clean, as certainly was the case with Waterhouse's specimen, the original being still in the British Museum.

Type (British Museum no. 47. 10. 21. 3), Tunis. Collected and presented by — Fraser.

Measurements (taken from the dried skin) :—

Head and body (c.) 400 millim.; tail 75; hind foot 100; ear 136.

Skull: greatest length 82; greatest breadth 41; breadth of maxillæ below lachrymals 28; length of nasals, middle line 28, greatest length 35, greatest breadth 20·2, across narrowest part 13·5; intertemp. constr. 12; basal length 61; length of upper molar series (tooth-sockets) 14·5; depth from top of nasals to palate immediately in front of premolars 19·5, above front of palatal foramina 15·5; mandible, length (bone only) from back of condylar process to upperside of back of incisors 60, upperside of back of incisors to angle 56; greatest height standing on table perpendicularly to condyle 37.

There are two specimens of this hare in the British Museum, presented by the same collector as the type specimen, labelled "Island of Kerkenna, off Tunis." The specific name is the genitive of Tuneta, the earlier form of Tunis.

XXVI.—*On a Collection of Heterocera made in the Transvaal* *.
By Sir GEORGE F. HAMPSON, Bart., B.A.

Pyralidæ.

GALLERIANÆ.

Lamoria imbellæ, Wlk. xxx. 955.

Pretoria.

CRAMBINÆ.

Crambus (Propeusus) tenuistriga, sp. n.

Head and thorax pale brownish; abdomen whitish. Fore wing brassy yellow, with a fine white stripe slightly defined by fuscous from base through the cell to termen below apex; traces of dark points beyond lower angle of cell and of a sub-terminal series; a more prominent terminal series. Hind wing whitish.

Hab. Pretoria (*Distant*), numerous specimens. *Exp.* 24 millim. Type in B. M.

The only *Crambus* with pectinated antennæ recorded from the Old World.

* [I am indebted to Sir George Hampson for thus working out the collection of Pyralidæ I made in the Transvaal during the years 1893-96. The species were almost all taken at Pretoria, and I have added the names of fifteen others taken during my first visit (1890-91) and one which I recently described in these pages.—W. L. DISTANT.]

Crambus carpherus, sp. n.

Head, thorax, and fore wing uniform pale brownish straw-colour; abdomen whitish. Hind wing pure white, the termen pale brownish towards apex.

Hab. Pretoria (*Distant*), five specimens. *Exp.*, ♂ 32, ♀ 38 millim. Type in B. M.

Nearest to *C. dielota*, Meyr.

Crambus heliocaustus, Wllgrn. *Öfvs. Ak. Forh.* xxxii. 1, p. 126.

Pretoria.

Crambus fulvitinctellus, Hmpsn. *P. Z. S.* 1895, p. 929.

Pretoria.

Crambus leucoschalis, sp. n.

Fore wing with vein 11 becoming coincident with 12.

Head, thorax, and abdomen white; antennæ, palpi at sides, and patagia brown. Fore wing golden brown, the costa narrowly and inner area white; a pure white fascia from base through the cell to termen below apex, expanding in end of cell and giving off a short spur on vein 2, and defined on upperside by a black streak beyond the cell; two oblique bronze and white streaks from costa before apex to the white fascia, the outer angled and becoming a subterminal line with an oblique white vitta from it to apex; the terminal area below the white fascia pencilled with grey and with fine black streaks on the veins; fine black lines on termen and through cilia. Hind wing yellowish white.

Hab. Pretoria (*Distant*), four specimens. *Exp.* 28 millim. Type in B. M.

Platytes albipenella, Hmpsn. *P. Z. S.* 1895, p. 946.

Pretoria; agrees well with the type from N.W. Himalayas.

Platytes tritonella, sp. n.

Head and thorax greyish white; palpi fuscous at sides; abdomen yellowish white, dorsally tinged with brown towards base. Fore wing yellowish white, thickly irrorated between the veins with long black scales. Hind wing silky yellowish white.

Hab. Natal; Transvaal, Barberton (*P. Rendall*). *Exp.*, ♂ 40-42, ♀ 32 millim. Types in coll. Rothschild and B. M.

Ancylolomia chrysographella, Koll. Hüg. Kasch. iv. p. 494.

Pretoria (*Distant*), Barberton (*P. Rendall*). A long series of specimens showing all the extremes of variation.

Ancylolomia uniformella, Hmps. P. Z. S. 1895, p. 967.

♂. Differs from the female from Sind in the antennæ having long uniserrate branches; head, thorax, and fore wing thickly irrorated and suffused with fuscous; hind wing fuscous, the basal area white.

Pretoria; one male.

SCHENOBIANÆ.

Scirpophaga gilviberbis, Zell. Mon. Chil. & Cramb. p. 2.

Pretoria.

Schænobius porrectellus, Wlk. xxvii. 140.

Pretoria; one male and one female, agreeing with the series from Brazil.

ANERASTIANÆ.

Pectinigeria subcarnella, Rag. Nouv. Gen. p. 44.

Pretoria; a long series.

Emmatheudes straminella, Snell. Tijd. v. Ent. (2) vii, p. 107, pl. viii. fig. 9.

Pretoria; a long series.

Comorta nigricostalis, Wlk. xxvii. 40.

Pretoria; one male and one female.

HYCITINÆ.

Homæosoma mucidella, Rag. N. Am. Phyc. p. 15.

Pretoria (*Distant*); Cape Colony. Does not appear to differ from N. American examples.

Microthrix inconspicuellæ, Rag. Nouv. Gen. p. 17, and Mon. Phyc. pl. xiii. fig. 17.

Pretoria; one male.

Oligochroa coriacella, Rag. Nouv. Gen. p. 21, and Mon. Phyc. pl. xii. fig. 18, and pl. xiii. fig. 16.

Pretoria; one male.

Nephopteryx ferrealis, sp. n.

♂. Antennæ biserrate, the tuft well developed; maxillary palpi dilated with scales and appressed to frons. Head and collar tinged with ferruginous; antennæ blackish; thorax grey-brown; abdomen pale grey. Fore wing brownish grey, irrorated with dark scales; a ferruginous line just before the middle edged by tufts of black scales; a rufous and dark discoidal spot; a subterminal whitish line strongly defined by ferruginous and black scales, and very slightly bent inwards to costa and at vein 5 and outwards to inner margin; a dark terminal line. Hind wing brownish grey, with brown terminal line.

Hab. Pretoria (*Distant*), one male. *Exp.* 30 millim. Type in B. M.

PYRALINÆ.

Aglossa basalis, Wlk. xxxiv. 1250.

Pretoria (*Distant*).

Triphassa albialis, Wlk. xviii. 640.

Pretoria (*Distant*).

Bostra puncticostalis, sp. n.

Antennæ of male not serrate, with two pairs of long cilia from each joint.

Head whitish and rufous; thorax dark rufous brown; abdomen pale reddish. Fore wing fuscous brown, with a reddish tinge; a pale sinuous antemedial line, defined by fuscous on outer side; a dark discoidal spot; the medial part of costa with numerous pale points; a pale postmedial line defined by fuscous on inner side, minutely dentate between veins 5 and 2, then incurved; a terminal series of dark points. Hind wing fuscous brown, with indistinct curved postmedial line. Underside with the costal area of fore wing and the hind wing tinged with yellow and red.

Hab. Pretoria (*Distant*). *Exp.* 38 millim. Type in B. M.

Bostra noctuina, Butl. Ann. & Mag. Nat. Hist. (4) xvi. p. 412.

Pretoria (*Distant*).

Bostra albilineata, Warr. Ann. & Mag. Nat. Hist. (6) vii.
p. 437.

Pretoria (*Distant*).

Bostra vetustalis, Zell. Lep. Caffr. p. 17.

Pretoria (*Distant*).

Zitha ignalis, Guen. Delt. & Pyr. p. 129.

Pretoria (*Distant*); Johannesburg (*J. N. Gregoe*).

Zitha laminalis, Guen. Delt. & Pyr. p. 129.

Pretoria (*Distant*).

Sindris albimaculalis, Rag. Ann. Ent. Soc. Fr. 1891, p. 113.

Pretoria (*Distant*).

The white spot on fore wing more prominent than in West-African examples.

HYDROCAMPINÆ.

Nymphula circealis, Wlk. xvii. 460.

Pretoria (*Distant*).

PYRAUSTINÆ.

Entephria caberalis, Guen. Delt. & Pyr. p. 284.

Pretoria (*Distant*).

Zinckenia fascialis, Cram. Pap. Exot. iv. pl. cccxcviii. O.

Pretoria (*Distant*).

Pagyda traducalis, Zell. K. Vet.-Ak. Handl. 1852, p. 54.

Pretoria (*Distant*).

Glyphodes negatalis, Wlk. xvii. 468.

Pretoria (*Distant*).

Glyphodes baldersalis, Wlk. xviii. 527.

Pretoria (*Distant*).

Glyphodes sinuata, Fabr. Spec. Ins. ii. p. 267.

Barberton (*Harrison*).

Leucinodes vagans, Tutt, Ent. Rec. i. p. 203.

Pretoria (*Distant*).

Described from Somersetshire, but imported.

Terastia margaritis, Feld. Reis. Nov. pl. cxxxvi. fig. 40.

Pretoria (*Distant*).

Noorda fessalis, Swinh. P. Z. S. 1886, p. 459, pl. xli. fig. 13.

Pretoria (*Distant*).

Phlyctænodes fulvalis, Warr. Ann. & Mag. Nat. Hist. (6) ix.
p. 301.

Pretoria (*Distant*).

Phlyctænodes frustalis, Zell. Lep. Caffr. p. 48.

Pienaars River (*Distant*).

Phlyctænodes venustalis, Cram. Exot. Schmett. iv. pl. ccclxxi. I.

Pretoria (*Distant*).

Nomophila noctualis, Schiff. Wien. Verz. p. 136.

Pretoria (*Distant*).

Pionea ferrugalis, Hübn. Samml. eur. Schmett., Pyr. figs. 54,
130.

Pretoria (*Distant*).

Pyrausta diniasalis, Wlk. xviii. 649.

Pretoria (*Distant*) ; four males, exactly similar to specimens from N.W. Himalayas and Shanghai.

Pyrausta incoloralis, Guen. Delt. & Pyr. p. 332.

Pretoria (*Distant*).

Pyrausta aurea, Butl. Ann. & Mag. Nat. Hist. (4) xvi.
p. 414.

Pretoria (*Distant*).

The following is a list of my captures in Pyralidæ which, with one exception, were taken during my first visit to the

Transvaal in 1890-91. For many of these identifications I was indebted to Mr. E. Meyrick, and they are used on his authority.—W. L. DISTANT.

- Crambus contaminellus*, Hübn. Pretoria.
Eromene ocella, Haw. Pretoria.
Nephopteryx apotomella, Meyr. Pretoria.
Myelois Bohemani, Zell. Pretoria.
Etiella zinckenella, Tr. „
Macna Hampsoni, Dist. Barberton.
Pyralis farinalis, Linn. Pretoria.
 — *illutalis*, Zell. Pretoria.
Dichocrosis amyntalis, Wall. Pretoria.
Lygropia quaternalis, Zell. „
Euclasta Warreni, Dist. Pretoria, Johannesburg.
Acharana otreusalis, Walk. Pretoria.
Pionea africalis, Guen. „
Pyrausta infuscalis, Zell. „
Titanio florilegaria, Guen. Pretoria.
Essina atribasalis, Rag. „

XXVII.—*On the Skull of Mochlorhinus platyceps, from Bethulie, Orange Free State, preserved in the Albany Museum, Grahamstown.* By H. G. SEELEY, F.R.S., Professor of Geology, King's College, London.

SIR R. OWEN, in 1859, discriminated from *Dicynodon* some fossil reptiles, which were named *Ptychognathus*. That genus was defined by the sharp angular transverse ridge, in which the more or less flattened top of the head meets the strongly ridged long straight face. This character was made more manifest in 1870, in the same author's 'Illustrated Catalogue of South African Reptilia,' by references to the plates in which those characters are drawn. The transverse fold or ridge has been shown in every species of the genus which has been figured. The name represents an important generalization and has been generally used.

Count Marschall recorded, in 1873, that the name had been applied to two different genera, and the references were brought under my own notice by the late Mr. G. R. Crotch about 1869. Subsequently, with the aid of Professor F. Jeffrey Bell, I examined the references to *Ptychognathus*, the crustacean, which occur in the writings of Professor A. Milne-Edwards and Mr. Miers, without finding that the genus had become well known. Mr. R. Lydekker, F.R.S., in 1889, urged that since Stimpson published the name in 1858, it was not available for use by Owen in 1859. In some human

affairs long-continued usage justifies and establishes a title ; and since nomenclature is a matter of convenience, it is a nice point whether the unchallenged use of Owen's name for a long time has given the reptile a preference over the crustacean.

Professor Cope, in 1870, without apology, proposed the name *Lystrosaurus* for a South-African fossil from which he drew many of the characters of the skull in defining the Dicynodontia. When this specimen was accurately figured in 1892 it proved to be a typical example of *Ptychognathus*. If that name should be eventually withdrawn from the South-African fossil, *Lystrosaurus* is the only name which could take its place, as Professor Cope has urged ; Zittel and others have continued to use the name *Ptychognathus*.

In 1889 Mr. Lydekker discarded *Ptychognathus* and adopted in place *Ptychosiaqum*, a new name applied by him to the Indian fossil from the Panchet rocks in the Lower Gondwana series, which Professor Huxley referred to *Dicynodon*, which may be conveniently retained for that type. The Indian specimens appear to differ in the shoulder-girdle, humerus, vertebræ, and all known parts of the skeleton from the remains of *Ptychognathus*, which are only obtained from the Upper Karroo rocks of South Africa, while *Dicynodon* is only known from the Middle Karroo series. No entire skull of the Indian genus is recorded, and there is no evidence that it has the generic character of a fronto-nasal angle in the skull which distinguishes *Ptychognathus* from *Dicynodon*.

The determination of the generic name is important because there are some allies of *Ptychognathus* which appear to show that it indicates a small family of South-African reptiles distinguished by the way in which the brain is elevated above the floor of the brain-case as it extends forward. This difference from some types of *Dicynodon* is comparable to that seen in modern crocodiles, in which the front of the brain is supported upon a median plate, while in Teleosaurs it rests upon the basicranial bones.

The subgeneric modifications which have come under my notice are two in number—first, a skull having a narrow longitudinally channelled cerebral region, with outwardly inclined sides, unlike the table-headed type of *Lystrosaurus* ; and, although the straight face makes an angular bend with the roof of the head, the surfaces are not parted by an angular ridge, but round into each other. That genus may be named *Rhabdotocephalus*, with the type *R. Maccaigi*. A second subgeneric form named *Mochlorhinus* is distinguished from the type *Lystrosaurus* by the perfect rounding of the face into the flat table-top of the skull, coupled with the development

of teeth upon the palate. There is no evidence of the skeleton associated with either skull; but the skull in the latter type is of some interest from its excellent preservation, which shows the sutures. In a previous paper (Phil. Trans. Roy. Soc. 1889, B, p. 290) I have drawn attention to a certain parallelism between the bones which cover the skull and the elements which roof over the spinal cord in some cartilaginous fishes. This now appears to me not only to explain why the median bones of the skull are sometimes single and sometimes paired, but to elucidate the presence of three bones in the Anomodont now to be described and in some other Vertebrata. Normally every single median bone, such as the intermaxillary (which alone is recognized in the Bidentalia termed Dicynodonts), is flanked by a pair of lateral bones—the premaxillaries. When the one is developed, the other commonly loses its individuality. So that the Theriodonts have a moderate development of premaxillary bones, but in Dicynodonts the intermaxillary is as strongly developed as are the premaxillary bones in *Ichthyosaurus*. The bone which I have termed infra-nasal in *Dicynodon* may be the premaxillary. The second median ossification in the skull—the ethmoid of birds—does not reach the surface in Dicynodonts, but appears to be related to the paired nasal bones in a similar way, though all three are rarely developed together on the surface of the skull. Next succeeds the single frontal of lizards with the pair of frontal bones on its flanks, followed by the single parietal and the pair of parietal bones; the last being the interparietal and the pair of superoccipital bones of Labyrinthodonts. Thus the roof of the skull would include the equivalents of five vertebral arches of fishes if all the elements were simultaneously developed. Without such a recognition of homology the presence of such bones as the interparietal, preparietal*, interfrontal, and intermaxillary cannot be explained. These median superior ossifications of the skull characterize Dicynodonts more than any other group of Anomodonts.

I have seen but one imperfect skull of *Mochlorhinus platyceps*. It was found many years since at Bethulie, a little north of the Orange River, near Aliwal North, by Mr. J. G. Donovan, who presented it to the Albany Museum. There I examined it in 1889. I am indebted to Dr. W. G. Atherstone, F.G.S., and the trustees of that museum for the opportunity of studying the specimen in this country and of

* The bone here named preparietal is named interparietal by Mr. E. T. Newton in Phil. Trans. B. 86, 1893, in explanations of plates xxvi. and

removing the matrix. There is no reason to anticipate the recovery immediately of other parts of the skeleton.

This head indicates one of the smaller *Bidentalia* (A. G. Bain), distinguished from many near allies by the singularly smooth texture of the bone, which is almost as well preserved as in specimens from English clays. The sutures are more distinct than usual, and establish relations of some bones which were previously less well shown. The head is a little distorted, in consequence of contortion which has affected the rocks.

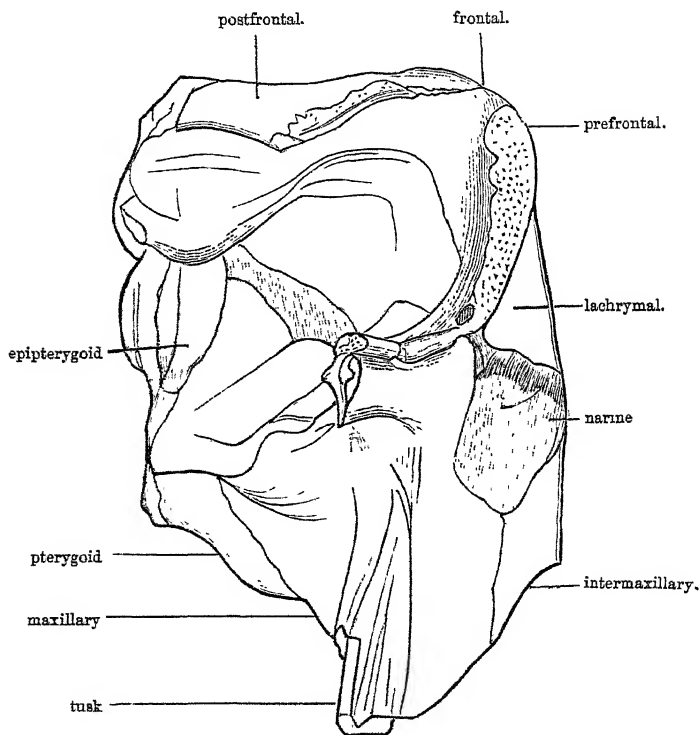
The genus *Mochlorhinus* is distinguished from *Ptychognathus* by three characters. First, the usual angular ridge between the upper surface of the skull and face is wanting, and the two areas, which commonly meet at an angle, graduate into each other in this animal by a smooth rounded transition, convex from above downward, concave from side to side (fig. 2). Secondly, the palate has the vomer elevated in front of the palato-nares, and the palatine bones at their sides so as to form three prominent tubercles. Upon the summits of these tubercles are minute teeth; they are small, flat, and circular on the summit of the vomer, but further back the teeth become much smaller and pointed (fig. 3). Thirdly, the head appears to be much more compressed from side to side than is usual in *Ptychognathus*, in which the skull is relatively wider in front of the orbits, giving the animals a table-headed appearance between the orbits. With this character is associated the position of the face at right angles to the crown of the head, giving an unusual depth from the frontal region to the palate, which exceeds the length from the nasal bones to the interparietal by almost one half that distance (fig. 1).

The genus is placed in the family *Ptychognatharhinidæ*. That group is characterized by the rapid elevation of the brain as it extends forward and abuts against the interorbital septum.

From the occipital plate the head measures 4 inches in length along the flat smooth crown to the rounded fronto-nasal surface. In vertical depth the measurement is about $7\frac{1}{2}$ inches from the frontal bone above the large lateral orbit to the point where the tusks, descending vertically, emerge through the maxillary bones. The roots of the tusks form prominent vertical rounded ridges, $3\frac{1}{2}$ inches long, at the sides of the head; they originate a little below the orbits, at less than 2 inches behind the vertical flattened prominence of the intermaxillary which forms the median part of the face. These lateral ridges give the face a transverse measurement of about 4 inches. The tusks have a diameter of $\frac{6}{10}$ inch at

the base, but both are broken and lost from the positions where they leave the maxillary bones. The transverse width between them on the palate is $1\frac{1}{2}$ inch. The roots of the tusks, as usual, are nearly parallel to each other, but converge slightly as they descend below the vomerine level of the palate. Seen laterally their contour is parallel to the lower part of the anterior outline of the nearly vertical face.

Fig. 1.

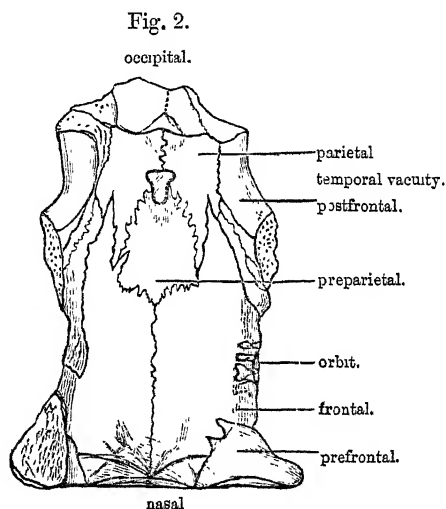


Right side of the skull of *Mochlorhinus platyceps*. $\frac{1}{2}$ nat.

The imperfections of the skull are:—loss of the anterior biting border of the intermaxillary bone between the tusks; the hinder part of the palate is missing, including the basi-sphenoid, together with all the bones which are about the foramen magnum; the squamosal and quadrate bones are lost with the malar arches which define the temporal vacuities, together with the descending postfrontal arches

which define the hinder border of the orbits. The bones are better preserved on the left than on the right side, but compression has partially closed the left orbit.

The flattened upper surface of the head is smooth, slightly concave from side to side, less than 4 inches long, and limited behind by a transverse ridge. That ridge is made by the interparietal bone, which is not vertical, but somewhat inclined forward. The interparietal makes the upper part of the occipital plate, and it abuts laterally against the pair of parietal bones. The transverse ridge which divides them is a slightly sinuous line of suture.



Superior surface of the skull of *Mochlorhinus platyceps*. $\frac{1}{2}$ nat.

The lateral borders of each side of the roof of the head include three areas:—First, the larger anterior part, which lies between the prominent prefrontal and the postfrontal bone, is the thickened, rounded, upper margin of the orbit, which is concave from front to back, formed in the middle by the frontal bone. Secondly, behind the orbits are the broken bases of the external processes of the postfrontal bones, which are thin, and probably descended in the usual way. Thirdly, behind these missing postfrontal processes are the obliquely inclined upper borders of the temporal vacuities. They are concave from front to back, slightly convex from above downwards, over an inch long, and about $\frac{6}{10}$ inch deep, margined superiorly by a sharp ridge, which is a suture separating the

inclined external surfaces, which are formed by the post-frontal bones, from the parietal bones upon which they rest. Underneath these areas the skull is excavated in the usual way.

The parietal bones are three in number. At their junction the parietal foramen is placed; it is oblong, keyhole-shaped, rather wider behind than in front, $\frac{4}{10}$ inch long, $\frac{3}{10}$ inch wide behind, and more than half that width in front; its transverse hinder border is $\frac{4}{10}$ inch from the posterior occipital ridge. The two parietal bones, which meet behind the parietal foramen in a sinuous median suture, form a slight inflation where the hinder end of the suture meets the interparietal bone. The flat parietals extend transversely outward to the margin of the inclined concave temporal vacuity formed by the postfrontal bone. Anteriorly the two parietal bones diverge, and a somewhat heart-shaped median preparietal bone is contained between the long narrow anterior processes of the parietals. External to those processes the frontal bones are prolonged backward upon the parietal bones, so as to divide their anterior border into a longer internal process and a shorter outer process. The single median bone (preparietal) is $1\frac{4}{10}$ inch long, though not measuring more than an inch in the median line, because its narrow hinder margin is notched out by the parietal foramen. It is $\frac{9}{10}$ inch wide in front where widest, and its convex serrated anterior border extends forward somewhat in advance of the narrow inner lateral parallel processes of the parietal bones which flank it. It is usually regarded as a parietal bone; but it is in the linear position of the interparietal, ethmoid, and intermaxillary bones, as occupying a median position in the skull alternately with the paired bones of the brain-case and face, such as the parietal and frontal. In osteology it has been sometimes treated as though it were the principal parietal, when the two posterior bones are often described as its posterior divergent processes among existing reptiles, when the interparietal bone is not separately ossified. Reasons have been urged for comparing these paired and unpaired ossifications with those found arching over the neural canal in the spinal column in *Lamna* and other Elasmobranch fishes, in which there is a similar alternation of paired and unpaired bones, which suggest a certain homology between the cranial and vertebral structures; and since the single median bone now described has much the same relation to the frontal bones that the interparietal has to the parietal bones, it may be known as the preparietal; it appears to be a good distinctive feature of these Anomodont skulls. It probably disappears in many

animals by blending with the parietal, just as the interparietal appears to blend commonly with the supraoccipital. When it is present, the preparietal has the aspect of being the key-structure of the roof of the brain-case, lying in front of the parietal foramen.

These three bones form the hinder part of the roof of the skull above the brain-case; they meet the frontal bones anteriorly.

Each frontal is an elongated oblong bone, and the pair unite by a slightly undulating median suture which extends forward just over the rounded angle between the face and the upper surface of the skull; their extremities converge in front and diverge as they extend backward.

The length of the median frontal suture is about 2 inches, though their extremities extend back so as to make each bone $3\frac{1}{4}$ inches long. The transverse width over the frontal bones in the middle of the orbits is about $2\frac{3}{4}$ inches, and, owing to the elevation of the margin of the orbit, the superior surface is transversely concave.

The transverse width of the skull increases in front owing to the way in which the prefrontal bones, which make the anterior corners of the orbits, are prolonged outward and downward, giving the orbits a position (fig. 1) which is entirely lateral, where the eyes look outward and very slightly upward. The prefrontal bone is only well preserved on the left side.

The postfrontal bone joins the frontal at the back of the orbit by a suture which is easily traced, and that bone thus enters into the upper surface of the skull, joins the parietal bone behind, and extends backward upon that bone so as to form the inclined concave borders of the temporal vacuities. This backward extension of a film of the postfrontal upon the parietal is substantially the same condition as is seen in the corresponding region in *Cynognathus* and other Theriodonts, notwithstanding the circumstance that in that group of animals the parietal bones form a median knife-like edge, and in this and many other Dicynodonts those bones form a broad flattened crown between these plates of the postfrontal. The suture is not usually seen, because it runs in the line of the slightly elevated ridge which defines the temporal concavity. Between this suture and the suture which limits the frontal bone there is manifestly another suture on the upper surface of the skull, defining a long narrow oblique bone which enters into the orbit at its upper hinder angle. It is about $1\frac{1}{4}$ inch long and about $\frac{3}{16}$ inch wide on the orbital border. It appears, therefore, to be in the position of the postorbital bones; for

the bone, which is only well preserved on the left side, is essentially an anterior dismemberment of the postfrontal, and it may possibly be prolonged downward to meet the malar bone.

The median upper border of the orbit is vascular and somewhat rugose. The internal surface of the bones of the orbit is smooth and regularly curved, and shows the sutures of the frontal with the other bones. The orbit was probably deeper than wide, the depth being $2\frac{3}{4}$ inches from the frontal bone above to the part of the maxillary which is above the base of the root of the tusk. The eye may have been slightly oblique and possibly looked to a small extent outward and forward as well as upward. The under surface of the postfrontal bones is smoothly excavated.

The external surface of the prefrontal bone differs in texture from the frontal in being less smooth, and agrees in this respect with the nasal bones, from which it extends laterally outward, and is defined by a distinct suture.

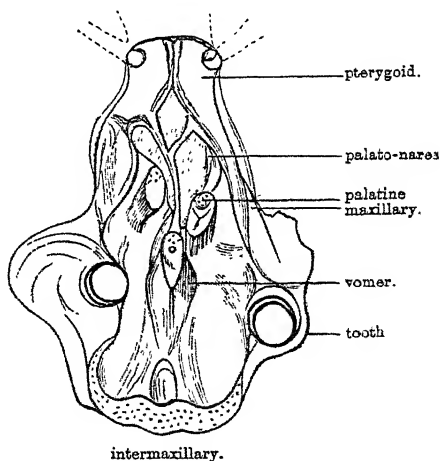
The skull of *Dicynodon tigriceps* has shown that the nasal bones extend transversely across the face, so as to meet the frontal bones behind them, where their transverse width exceeds the width of the prefrontal bones. In this genus the nares are relatively further forward and differently conditioned, so that the nasal bones are elongated from back to front. They constitute the upper border of the nares, are about $3\frac{1}{4}$ inches long and $2\frac{1}{4}$ inches wide. In the median line the nasal bones are overlapped in front by an unpaired bone—the intermaxillary—and that overlap causes them to appear to diverge as they extend forward. The hinder border of the nasal bone meets the lachrymal, which is large and placed between the prefrontal and nasal in front and the maxillary behind. It extends forward into the nasal vacuity, forming its hinder floor. The cavity which lodged the lachrymal gland was behind the nostril and below the eye, about $2\frac{1}{2}$ inches long and $\frac{6}{10}$ inch wide, rather narrower in the middle. The lachrymal duct is circular and has the usual position.

The single unpaired condition of the intermaxillary is not associated with a pair of premaxillary bones in this animal. The face comprises three regions—a narrow median anterior area, $1\frac{1}{2}$ to $1\frac{3}{4}$ inch wide, marked with a slightly elevated median ridge, and parallel to this are the rounded angles which separate this median anterior region from the oblique lateral areas. This long flat nose is very gently convex from above downward. A well-defined suture extends from the lower angle of the large diamond-shaped narine and divides the

anterior intermaxillary from the large maxillary bone behind it (fig. 1). This suture is straight and parallel to the base of the tusk in the maxillary bone, which is about an inch behind it. The face, which is about $2\frac{1}{2}$ inches in lateral depth from the flat nose to the roots of the teeth, has the aspect of being compressed from side to side. In the middle length of this compressed area, below the orbits and slightly in front of them, are the anterior nares. Another compression (parallel, vertical, and further backward) defines the inflation of the maxillary caused by the roots of the teeth (fig. 3).

In front of the tooth the palatal edge of the maxillary bone is compressed to a thin sharp cutting border, which descends below the palate, so that the sides of the lower jaw could work between the teeth. There is no doubt that the intermaxillary formed a continuation of this arch, which had the usual concave upward recession, though the cutting-edge of the middle part is fractured and lost. Behind the narine the jugal process of the maxillary bone is partly preserved, and behind and below this process the maxillary bone is greatly com-

Fig 3.

The palate of *Mochlorhinus platyceps*. $\frac{1}{2}$ nat.

pressed, for the head is narrower in transverse measurement behind the socket for the tooth than in front of it. The maxillary is prolonged backward above the pterygoid bone behind the palato-nares, as is shown in lateral aspect of the skull, and forms a wedge which narrows to its hinder termination (fig. 1).

In general plan the palate closely resembles that of the short-faced Dicynodonts. Its distinctive features consist in the development of a strong descending median ossification, which is a little behind the tusks and in advance of the palato-nares. It corresponds in position with the vomer and forms a compressed prominence, which is nearly 2 inches long and is prolonged backward as the narrow median ridge which divides the palato-nares. This ridge may be paralleled in many Dicynodonts and has been figured by Sir Richard Owen in the species of *Dicynodon* named *D. pardiceps*, *D. testudiceps*, and others. Another remarkable feature is the evidence that the bone internal to the maxillary and pterygoid and behind the vomer, which I regard as the palatine, develops a strong tubercle, flanking and defending the outer anterior corners of the palato-nares. The sutures are not shown which define the palatine from the pterygoid, but there is no reason to question the identification of these eminences as palatine tubercles. There appears to be a slight approximation to a similar condition in the palate of *Dicynodon pardiceps*. In view of the fact that the vomerine and palatine bones in *Taeniasaurus* and other allied reptiles bear teeth upon elevated ridges upon those bones, I was led to infer that, since they are on the same level, they might have a similar function. On the highest part of the vomer there are small teeth which are flat and rounded in front, though few are preserved. They are similar to the teeth figured in the South-African Cynodont *Ælurosaurus felinus*. On the hinder border of the vomer and palatine there are minute pointed teeth, recognized by their black enamel. I have not observed such strong palatine tubercles in any other fossil, nor are there evidences of teeth on the palate in the present condition of any Dicynodont skull in the British Museum.

The anterior terminations of the pterygoid bones external to the palatine tubercles are compressed from side to side and well separated from the maxillary bones in front of them by a vertical suture. The middle of their most convex anterior part, which makes the outward limit of the palatal border, is rough with short irregular sinuous wrinkles, as though pterygoid muscles had extended from them to the lower jaw.

The palato-nares are distorted; they were apparently almond-shaped, about $1\frac{1}{4}$ inch long, narrower in front than behind, and parted posteriorly by a median excavation like that seen in *Dicynodon pardiceps*, *D. Copei*, and other forms.

The transverse measurement over the anterior termina-

tions of the pterygoid bones is $1\frac{7}{10}$ inch. The palate begins to contract in transverse width from the moment that the pterygoid replaces the maxillary bone in forming its lateral margin; and behind the median post-narial vacuity, where the convex contour of the anterior process is exchanged for a contour concave from front to back, the transverse width of the united pterygoid bones is $1\frac{1}{10}$ inch. The pterygoid bones meet in the median line in a slight ridge; they are fractured transversely just behind the bases of the slender processes which appear to have been given off to the quadrate region, and all the hinder part of the smooth post-palate, with the adjacent bones, is lost.

The superior surface of the pterygoids supports the remarkable median plate first studied by Huxley in *Ptychognathus Murrayi*. It extends upward as a vertical partition between the orbits, and joins both the brain-case and its frontal prolongation forward. This thin partition consists of several bones; the uppermost and most anterior is identified as the orbito-sphenoid, and is most absolutely between the orbits, below the front of the brain-case, and below the frontal bones. A film of matrix may separate it from the bones below, which may be compared with those of *Dicynodon tigriceps* figured in the Phil. Trans. 1888. On the posterior fracture this median plate is shown as an extremely thin vertical film (fig. 1), but matrix rests upon it supporting a vertical bone external to the plate, which may be the element termed the columella or epi-ptyergoid, since it is between the parietal and pterygoid regions, though neither its upward nor downward terminations are preserved. In front of it, manifestly rising from the pterygoid, are the two films of bone which extend towards the orbito-sphenoid; the hinder of these I have generally termed the median plate of the pterygoid, but it now seems not improbable that this thin ossification should be the alisphenoid, since it is immediately under and apparently continuous with the brain-case and extends downward to the sphenoidal region. An oblique suture which extends upward and forward separates it from the presphenoid. Both those bones appear to be truncated above and to meet the orbito-sphenoid, though the matrix already referred to either intervenes between the bones or hides their junction. In front of the presphenoid there is manifestly another bone immediately above the position of the vomer. It is situate between the nares and extends forward to the position of the nasal bones, so that it is in the position of the ethmoid.

All that remains of the occipital region is the median part

of the interparietal bone, which is about an inch deep, broken on each side, has a vertical median ridge, and at its base shows a fractured fragment of the supraoccipital, which is excavated on its anterior border by a vertical concavity like that seen in figured *Dicynodonts* in the British Museum, which display the cerebral aspect of the occipital plate. The bone is obviously narrow; at its sides are the thin walls of the brain-case; those walls meet inferiorly in the median line, so as to rest upon the interorbital septum which has been described; and it extends backward to the supraoccipital and interparietal bones, but not much in advance of the anterior angle of the bevelled concave temporal region, where the postfrontal rests on the parietal. The parietal bones form the upper covering of this brain-case.

All the allied skulls which I have seen from the Upper Karroo rocks are remarkable for side to side compression, while the *Ptychognathus* type widens superiorly to the flat interorbital table on the top of the head.

XXVIII.—On *Indigenous Muridæ in the West Indies; with the Description of a new Mexican Oryzomys*. By OLD-FIELD THOMAS.

IN Mr. F. M. Chapman's interesting paper on the origin of West-Indian bird-life* it is assumed that there are no indigenous terrestrial mammals in the Greater Antilles other than *Solenodon*, *Plagiodontia*, and *Capromys*, or in the Lesser Antilles than *Dasyprocta cristata* (to which should be added *Megalomys pilorides*).

For more than half a century, however, there has been in the British Museum a rat from Jamaica belonging to the genus *Oryzomys*, and closely allied to the Central American *O. Couesi*, while another indigenous species has now turned up in a member of the same genus from St. Vincent, collected by Mr. H. H. Smith about six years ago, but hitherto overlooked.

In view of the fact that, as is evidenced by their rarity, these indigenous Murines are rapidly disappearing before the competition of the introduced European rats and mice, these specimens are of much interest as furnishing valuable evidence about the character of the original West-Indian fauna.

* "Notes on Birds and Mammals observed near Trinidad, Cuba, with Remarks on the Origin of West-Indian Bird-life," Bull. Am. Mus. N. H. iv. p. 279 (1892).

Both the specimens appear to represent new species, although closely allied to continental forms.

The first may be called

Oryzomys antillarum, sp. n.

Size about as in *O. Couesi*. General colour dull rufous, rather (though not prominently) richer on the rump and greyer on the head; black lining of back not prominently marked. Belly dull yellowish, not sharply defined, the hairs slaty grey basally. No blackish ring round eyes. Ears small, their visible external surface blackish and internal yellowish, but in neither case very strongly contrasting with the general colour. Hands and feet dull whitish above. Tail apparently about as long as the head and body, very thinly haired, almost naked, pale brownish above, rather lighter below.

Skull strongly built, with well-defined evenly divergent supraorbital ridges. Nasals well surpassing frontal processes of premaxillæ posteriorly. Interparietal small and narrow. Palatal foramina narrow, rather compressed, not widely open. Back of palate extending behind $m.^3$ a distance about equal to the diameter of that tooth.

Dimensions of the type (measured in skin):—

Head and body (apparently stretched) 120 millim.; tail (imperfect at tip) 130; hind foot, without claws (moistened), 28; ear (moistened) 13.

Skull: basal length (c.) 26, basilar length (c.) 24; greatest breadth 17; nasals 12.6×4.1 ; interorbital breadth 5.2; breadth of brain-case on squamosals 12.9; interparietal 2.8×8.5 ; palate length from henselion 14; diastema 8.3; palatal foramina 5.7×2.1 ; length of upper molar series 4.6.

Hab. Jamaica.

Type B. M. no. 45. 10. 25. 48. Collected by Mr. P. H. Gosse.

The evident relationship of this Jamaican *Oryzomys* to the *O. Couesi* group is distinctly confirmatory of Mr. Chapman's view that the Greater Antilles received their inhabitants from Central America (probably Honduras and Nicaragua) *viâ* the Pedro Cays and Jamaica, rather than from the North (Florida) or the South (Trinidad), in neither of which regions is any such *Oryzomys* known.

Gosse's "*Mus saccharivorus*"*, the "Cane-piece Rat," is clearly not this species, and is most probably *Mus decumanus*.

Besides Mr. Gosse's specimen in the British Museum there

* 'Naturalist in Jamaica,' p. 444.

are also two skins, presumably of *O. antillarum*, in the United States National Museum, as appears from Dr. Coues's remarks in his Monograph of N.-American Muridæ*. They were captured about 1877.

The fact that no specimen of this or any other indigenous Murine has been taken in Jamaica for the last twenty years, while *Mus rattus* and *decumanus* have devastated the island, to be persecuted in their turn by the introduced Indian Mongoose, renders it highly probable that this animal has been altogether exterminated there, like the Carib inhabitants of the same region. But in the larger islands—Cuba and Hayti—it is very likely that it (or a closely allied species) still persists in the little known interior, where disturbances and misrule have as yet prevented any scientific exploration.

The second species (that from St. Vincent) may be termed

Oryzomys victus, sp. n.

Size and proportions about as in the larger members of the *O. longicaudatus* group. General colour dark rufous, but evidently affected by the spirit in which the specimen has been preserved. Under surface buffy white, the bases of the hairs slate-colour. Eyes without darker rims. Ears short, the anterior part of their backs brown, not strikingly contrasting with the general colour of the head. Hands and feet thinly clothed with fine silvery hairs. Tail almost naked, brown above, slightly paler below. Mammæ 2—2=8.

Skull with the general shape of that of South-American *O. longicaudatus*, the brain-case being similarly lengthened as compared with the broadened brain-case of the Central-American *O. melanotis* and its allies. Compared with a Rio Janeiro example it is larger, more rounded, the supraorbital edges less sharply square, but the parietal ridges thicker and better developed. Molars larger and stouter, palate ending only just behind the back of *m*.³.

Dimensions of the type (an adult female, measured in spirit):—

Head and body 96 millim.; tail 121; hind foot without claws 25, with claws 26·7; ear 14.

Skull: basilar length 21·4; basal length 23·8; greatest breadth 15·1; nasals 11·2×3·4; interorbital breadth 4·5; interparietal 3·2×10; palate length from henselion 12·3; diastema 7·8; palatal foramina 5·4×1·8; length of upper molar series 4·1.

Hab. St. Vincent, Lesser Antilles.

* Mon. N. Am. Rod. p. 116 (footnote), 1877.

Type B. M. no. 97. 12. 26. 1. Collected by Mr. H. H. Smith, and presented by Mr. F. DuCane Godman.

Owing to our ignorance of South-American Muridæ it is difficult to say to what species this mouse is most nearly allied; but, as already stated, it seems related to Southern rather than Central American forms, and is therefore again confirmatory of the view supported by Mr. Chapman as to the essential difference in the origins of the faunas of the Lesser and Greater Antilles.

The specimen was marked by Mr. Smith as a "Forest Rat."

Oryzomys Chapmani, sp. n.

Oryzomys melanotis, Allen and Chapman, Bull. Am. Mus. N. H. ix. p. 205 (1897).

The British Museum has acquired half the interesting collection obtained by Mr. F. M. Chapman at Jalapa, Mexico, and worked out by Allen and Chapman. Among them there is a series of the *Oryzomys* termed by them *O. melanotis*, Thos., and at the request of Mr. Chapman I have made a careful comparison of them with the type of that species, obtained by the late Dr. Buller in Jalisco.

The two forms are undoubtedly very closely allied, but are not identical, and I would therefore propose to name the Jalapa form in honour of its discoverer Mr. F. M. Chapman, to whom science is indebted not only for much valuable material collected by him, but also for many interesting papers on his own and other people's specimens.

Size markedly smaller than in *O. melanotis*, as shown especially in the skull. General colour much darker, the black lining on the back finer and closer and the light colour less bright. Lower surface more strongly suffused with slate. Ears (unfortunately for the name) even blacker than in *O. melanotis*, the visible portion of the inner as well as of the outer surface deep shining black. Wrists and ankles more or less suffused with smoky brown. Tail as in the allied species.

Skull very similar in shape to that of *O. melanotis*, but much smaller; nasals narrower behind. Brain-case narrower (width between most distant points of parietal ridges 10·8 to 11·0 millim., as against 12·1). Palatal foramina much shorter and extending nearly to the level of the front of *m*.¹. Posterior narial fossa shorter. Bullæ smaller.

Dimensions of the type (an adult female measured by Mr. Chapman in the flesh):—

Head and body 105 millim.; tail 116; hind foot, with claws, 24; ear 19.

Skull: basal length 21·6: basilar length 19·8; greatest breadth 13·8; nasals 10·4×3·2; interorbital breadth 4·3; breadth of brain-case on squamosals 11·4; interparietal 2·8×8·9; palate length from henselion 11·5; diastema 11·7; palatal foramina 4·5×2; length of upper molar series 3·7.

Additional measurements and averages are given by Allen and Chapman (*l. c.*).

Hab. Jalapa, Mexico.

Type B. M. no. 97. 9. 9. 30. Original number 1059. Collected by Mr. F. M. Chapman, March 31, 1897.

BIBLIOGRAPHICAL NOTICE.

Land and Freshwater Mollusca of India, including South Arabia, Baluchistan, Afghunistan, Kashmir, Nepal, Burmah, Pegu, Tenasserim, Malay Peninsula, Ceylon, and other Islands of the Indian Ocean. Vol. II., Part VII. By Lieut.-Colonel H. H. GODWIN-AUSTEN, F.R.S., F.G.S., F.Z.S., &c.

VOLUME I. of this work, consisting of 266 pages and 62 plates, was commenced in 1882 and completed in 1888. The present Part VII. (the first of Vol. II.) was issued last October, and contains 45 pages of text accompanied by 7 plates.

As indicated by its title, this work is mainly devoted to the subject of Indian malacology, but occasionally we are startled by the sudden appearance of a page or two dealing with molluscs from very remote parts of the world. In the first volume, for example, the British *Geomalacus maculosus* is discussed, a new species of *Helicarion* from Australia, and a new *Diplommatina* from Trinidad, W.I., are described, and a new subgenus of *Helicarion* (*Africarion*) is founded for the reception of certain African forms. In the part before us a new subgenus of *Cyclophorus* (*Natalia* *) is described, for the reception of the well-known *C. Wahlbergi* of South Africa. It is as well to call attention to this introduction of extraneous matter, so that writers engaged upon the fauna of Greenland, Timbuctoo, or any other part of the world may be on the alert.

About 17 of the 45 pages are reprints of the author's descriptions which have appeared in the 'Proceedings of the Zoological Society' or are quotations from the works of other writers. It is very useful to have these descriptions reproduced, as they are accompanied by figures, not having been illustrated previously. The genera treated of are *Alyceus*, *Diplommatina* †, *Cyclophorus* (subgenera *Natalia* and *Cyclohelix*), *Otopoma*, and *Pupina*. Only two new species are described, and they belong to the last-named genus. The anatomical part of this work is very slight, being restricted to an account of the position of "the male organ" in the new subgenus *Natalia*

* Used by Gray in 1840 in Echinoderma.

† *D. concinna*, p. 15. This name was preoccupied by H. Adams twenty-five years ago.

and in *Cyclophorus crocatus*, and to "some details of the anatomy" of *Otiopoma* contained in ten lines on p. 30. The radulæ also of this genus and two species of *Tropidophora* are described. There are some slight inaccuracies in the nomenclature, which is scarcely up to date; for example, it has been pointed out in these 'Annals' as long ago as 1891 that the name *Cyclostoma* can no longer be used for the genus of operculated land-shells to which it has generally been applied, and therefore the family name "Cyclostomidae," which should be Cyclostomatidae, also becomes obsolete. *Cyclostoma elegans* is more than once erroneously referred to as the type of *Cyclostoma*, and mention is made (p. 34) of a viviparous *Bulinus* at Aden. Three writers at least within the last few years have pointed out that Scopoli did not originally apply this term to a land-shell, but to a freshwater form. There is also a mistake with regard to the authorship of the 'Catalogue of Phaneropneumona or Terrestrial Operculated Mollusca in the Collection of the British Museum,' to which attention should be directed. It is several times referred to as Gray's work, whereas, as stated in the preface, it was prepared by Dr. L. Pfeiffer. In speaking of the subdivision of the genus *Cyclophorus* ten so-called subgenera are enumerated. No mention, however, is made of *Crossopoma*. Crosse, *Ptychopoma*, Mollendorff, *Japonia*, Gould, *Aferulus*, Martens, *Ostodes*, Gould, and some other groups, so that we are left in ignorance as to the author's views respecting these sections. The statement with regard to the distribution of the *Pupinæ* (p. 37) is not accurate, as certain members of the group occur in Japan, Formosa, and as far eastward as the Solomon Islands, New Hebrides, and Fiji Islands.

The seven plates, drawn by the author, do not possess a highly artistic finish, but this is probably compensated by the accuracy of outline of the figures and the true indication of the sculpture. The drawings of the soft parts (plates lxvii. and lxviii.), although characteristic perhaps, do not exhibit the precision and clear definition usually furnished by the anatomist.

As a contribution to Indian malacology this work undoubtedly possesses a certain value which recommends its continuation; moreover, the author having lived and personally worked in the country, is in a position to speak with special authority upon the Indian fauna.

MISCELLANEOUS.

Pierine Butterflies of the Genus Terias.

To the Editors of the 'Annals and Magazine of Natural History.'

GENTLEMEN,—In my article on *Terias* I omitted to erase *T. hainana*, Moore (*suprà*, p. 63), as a synonym of *T. betheseba*, which it superficially resembles, though actually a form of *T. libythea*.

I am, Gentlemen,

Yours &c.,

A. G. BUTLER

“*Butterflies from the Pacific Islands.*”

To the Editors of the ‘Annals and Magazine of Natural History.’

GENTLEMEN,—In answer to Mr. Sclater's letter of December 2nd, published in your last number, I have to make the following remarks.

I find on referring to my edition of Mr. Keith Johnston's Atlas that the Timor group, New Guinea, and the Solomon Islands are all included in his map of “The Islands of the Pacific Ocean”—so that, if I have erred, I have erred in good company.

I venture to think that Mr. Sclater's observations, in which he accuses me of a “serious geographical error,” are somewhat hypercritical. The islands in question, being situated in the Pacific Ocean, may not inaptly be termed Pacific Islands, though they are separated by more or less considerable distances from other groups of islands, which are more in the centre of the Pacific Ocean. I am not acquainted with any authority which restricts the term “Pacific Islands” to these last-named groups; but even though there be such authority, I still think that the title to my series of papers on the butterflies found in the numerous islands of Oceania, with the last of which series Mr. Sclater has found fault, is sufficiently accurate for the purpose for which the papers were written. They were prepared for the perusal of entomologists, and I think I am not far wrong in supposing that no entomologist would be misled by the title, though such title might not, technically, satisfy a geographer.

The title appears to me adequate, and sufficiently accurate to indicate to entomologists, *in general terms*, the quarter of the globe in which the butterflies were captured. If this be so, my object in thus designating my papers has been attained.

I hope I may never be accused of a more “serious error” than that which Mr. Sclater has attributed to me.

I am, Gentlemen,

Your obedient Servant,

5 Bryanston Square, W.

H. GROSE-SMITH.

8th January, 1898.

Note on the Genera Choristoneura, Mabille, and Katreus, Watson.

By F. A. HERON.

Dr. W. J. Holland in his most useful “Preliminary Revision and Synonymic Catalogue of the Hesperiidæ of Africa and the adjacent Islands,” in the Proc. Zool. Soc. 1896, p. 74, quotes the genus *Katreus*, Watson, with its type species *Astictopterus Johnstonii*, Butler, Proc. Zool. Soc. 1887, p. 573, and also a figure of his own in the ‘Entomological News,’ vol. v., Jan. 1894, pl. i. f. 8, as representing Butler's species, and gives a further reference to Proc. Zool. Soc. 1896, pl. ii. fig 18. This figure was afterwards correctly ascribed to *Gorgyra abura*, Plötz, by Karsch in a note on Holland's paper published in Ent. Nachr. xxii. p. 377 (1896).

On page 83 of his Revision occurs the mention of the genus *Choristoneura*, Mabille, a coloured figure of the type *Choristoneura apicalis*, Mab., being given on pl. v. f. 1, and a cut of the neurination

on page 83, with the following note:—"This very remarkable insect is entirely unlike any other species which I have ever seen from the African continent, and recalls in general appearance some of the species of the S. American genus *Entheus*. At the time Lieut. Watson prepared his Revision of the genera of the Hesperiidæ, no specimen of this insect was available by him for purposes of study. I take pleasure in incorporating a cut giving the neururation. From this it will be seen by the student that the neururation is quite peculiar, and that Mons. Mabille, the author of the genus, was abundantly justified by the facts in erecting it for the reception of the typical species."

A reference to Watson's paper, Proc. Zool. Soc. 1893, p. 130, shows *Choristoneura*, Mab., type *apicalis*, Mab., among the genera "of which the types are not in the British Museum," and which consequently he was "unable to identify."

If the student compares together the excellent figure of *Choristoneura apicalis*, Mab., in Proc. Zool. Soc. 1896, pl. v. f. 1, and Mabille's very short description of his species in Bull. Soc. Ent. Fr. (6) vol. ix. p. clvi (1889), with Butler's description of *Astictopterus Johnstonii*, Proc. Zool. Soc. 1887, p. 573, he will at once notice that figure and description refer to the same form, which must therefore stand as *Johnstonii*, Butler.

A similar comparison of Mabille's slight definition of *Choristoneura* in the 'Bulletin,' and the cut of neururation given by Holland on p. 83, Proc. Zool. Soc. 1896, with Watson's more detailed definition of *Katreus*, P. Z. S. 1893, p. 115, will show the identity of *Choristoneura* and *Katreus*.

Karsch, in the communication referred to above, had recognized his own *Loxolexis percnoptera* from Barombi as a synonym of *Choristoneura apicalis*, Mab., by the aid of the figures given by Holland.

The species will thus stand as *Choristoneura Johnstonii*, Butler (*apicalis*, Mabille), and the fuller synonymy will be:—

Choristoneura, Mabille, Bull. Soc. Ent. Fr. (6) ix. p. clvi (1889). Type *apicalis*, Mabille.

Katreus, Watson, Proc. Zool. Soc. 1893, p. 115. Type *Johnstonii*, Butler.

Loxolexis, Karsch, Ent. Nachr. xxi. p. 320 (1895). Type *percnoptera*, Karsch.

Astictopterus Johnstonii, Butler, Proc. Zool. Soc. 1887, p. 573.

Choristoneura apicalis, Mabille, Bull. Soc. Ent. Fr. (6) ix. p. clvi (1889).

Katreus Johnstonii, Watson, Proc. Zool. Soc. 1893, p. 115 (nec Holland, Ent. News, v. pl. i. f. 8, 1894; nec Holland, Proc. Zool. Soc. 1896, pl. ii. f. 18).

Loxolexis percnoptera, Karsch, Ent. Nachr. xxi. p. 321 (1895).

Choristoneura apicalis, Holland, Proc. Zool. Soc. 1896, pl. v. f. 1.

From the plate alone I am unable to say to what genus we must assign the species figured as *Katreus Johnstonii* by Holland, Ent. News, v. pl. i. fig. 8; but if the species prove new, it should certainly be described by the learned doctor, who in his recent paper has done so much to facilitate the study of the African Hesperiid

Martyn's 'Psyche.' By OLIVER E. JANSON, F.E.S.

In the January number of the 'Annals' Mr. Sherborn, in his "Note on Thomas Martyn's 'Psyche,' 1797," states that Mr. Van de Poll and Mr. Janson had not responded to his letters asking for information respecting the copy of this exceedingly rare work that was contained in my late father's library, and now in the possession of Mr. Van de Poll. As regards myself, I certainly never received any letter from him upon the subject, but believe he called at my office during my absence and made some vague enquiry of one of my assistants respecting the copy of the work, which had then passed out of my possession and had been in Holland, with Mr. Van de Poll, for several years; but as he left neither a name or address, I was unable to communicate with him, and was under the impression that he intended to call again or write to me; and had he done so I should have been only too glad to avail myself of the opportunity of giving him any information I was able to, and also to have allowed him to inspect the first two numbers of the work now in my possession, the second of which he states in his "Note" he has never seen, and wishes to hear about from anyone who may possess it. These two parts of the work with the original text are those he refers to under copy "No. 9," which he states were sold to Messrs. Dulau in 1838 and "not traced since." As a matter of fact they were purchased by me from Dr. A. G. Butler in March 1890 and bear his autograph. These parts are both in the original wrappers, evidently as issued. No. 1 agrees with the collation given by Mr. Sherborn and No. 2 consists of text sign. D, pp. 7 and 8 in English, and the same sign. and pp. repeated in French—page 7 in each case devoted to the description of "*Papilio daphnis*?" and page 8 to that of "*Papilio cresphontinus*," both species being figured on the accompanying plates.

The existence of the copy "No. 10" of Mr. Sherborn's list has probably arisen from some mistake, as Dr. Butler informs me he has no means of knowing what books Mr. Van de Poll possesses and has no recollection of having mentioned such a copy; it would therefore appear that the copy of the second part in my possession is the only one so far known to exist, and I shall be glad to allow anyone free access to it who may wish to consult it.

I entirely disagree with Mr. Sherborn in regarding the work as a manuscript; the first two numbers he must, at all events, admit are a regularly published work, and as regards the remaining twenty-eight plates, he admits they have been printed from engraved copper-plates and that a certain number of copies were issued, so that I cannot see why the mere fact of the names of the species having been omitted in the printing and filled in afterwards by hand should be sufficient grounds for regarding the whole as a manuscript. Even if no further portion of text should come to light, I believe it is generally held by naturalists that a good recognizable figure is quite as efficient to carry publication of a species as a printed description.

Highgate, N.
January 8th. 1893.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[SEVENTH SERIES.]

No. 3. MARCH 1898.

XXIX.—*Descriptions of Three apparently new Copepods from the Clyde.* By THOMAS SCOTT, F.L.S., Naturalist to the Fishery Board for Scotland, and ANDREW SCOTT, Fisheries Assistant, University College, Liverpool.

[Plates X. & XI.]

*Stephos Fultoni**, sp. n.
(Pl. X. figs. 1-8; Pl. XI. figs. 1-4.)

Description of the Female.—Body robust; abdomen moderately slender and composed of four segments, first segment somewhat dilated in the middle; viewed laterally this segment is seen to possess a spiniform and hook-like appendage on the inferior aspect and near the proximal end, while posteriorly there is a distinct fascicle of hairs (Pl. X. fig. 1); the length of the specimen is about 1 millim. ($\frac{1}{2}$ of an inch). The antennules are twenty-four-jointed, as in *Stephos minor*, but the proportional lengths of the joints differ somewhat, as shown by the formula (see also Pl. X. fig. 2)—

Proportional lengths of the joints...	10.	13.	17.	5.	5.	4.	4.	6.	3.	4.	4.	5.	5.	5.	6.	5.	5.
Number of the joints	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	5.	5.	5.	5.	6.	7.	5.										
	18	19	20	21	22	23	24										

* In compliment to T. Wemyss Fulton, M.D., F.R.S.E., Superintendent of Scientific Investigations, Fishery Board for Scotland.

The structure of the antennæ and of the mouth-organs resembles generally that of the same appendages in *Stephos gyrans* and *Stephos minor*, though differing in some minor details (Pl. X. figs. 3-5). The first, second, third, and fourth pairs of swimming-feet are also somewhat similar to those of the same two species, but the last three pairs are proportionally rather more slender and elongate (Pl. XI. figs. 1-3). The fifth pair are stout and in general appearance resemble those of the other species, but they differ in the following particulars:—the two members that compose the fifth pair, though nearly equal in length, are somewhat unsymmetrical; in the (?) right foot the end-joint is rather longer than the other and is of a broad knife-like shape, its inner margin is even and nearly straight, while the outer is finely serrated along the posterior half and curved inwards towards the apex; in the (?) left foot the end joint, which is about the same length as the first, is dilated near the proximal end, and after contracting somewhat abruptly on both sides tapers gradually to the extremity, where it terminates in a moderately sharp point (Pl. X. fig. 6).

Description of the Male.—The male does not differ much from the female except in the following particulars:—the abdomen, which consists of five segments, is rather more slender, and the first segment is not dilated. The fifth pair of thoracic feet, though having a general resemblance to those of the males of *Stephos gyrans* and *Stephos minor*, differ very markedly in some of the structural details; in the right foot the first and second joints are subequal and moderately short and slender; the third joint, which is also slender, is of considerable length, being about one and a half times the entire length of the first and second joints; the last joint is long, slender, and strongly falcate, so that it somewhat resembles a reaping-hook, the convex side being outward, the basal part of the joint is also produced inwardly into a process of a triangular form; the left foot terminates in a strongly dilated appendage, which is armed with a large and dark horn-coloured movable claw, distinctly bifid at the extremity; there are also, in addition to the claw, several elongate, flexuous, and spiniform apical processes, as shown in the figure (Pl. XI. fig. 4); it is thus evident that the two members of the fifth pair in the male form together a very powerful and efficient grasping-organ.

Hab. Kilbrennan Sound, Firth of Clyde, 1896; vicinity of Otter Spit, Loch Fyne, 1897.

Remarks.—The fifth pair of thoracic feet in both the males and females of the species now described are distinctly

different from the same appendages in *Stephos minor*, T. Scott, and *Stephos gyrans* (Giesbrecht), and are in themselves quite sufficient to distinguish it from those two species; moreover, it has to be noted that the fifth pair of thoracic feet in the female are scarcely symmetrical, and to that extent they indicate a departure from the normal characters of the genus.

Dactylopus pectinatus, sp. n.
(Pl. X. figs. 9-16.)

Description of the Female.—In general appearance this species is somewhat similar to *Dactylopus Stromii*; the animal is moderately robust, and the length of the specimen figured is about .7 millim. ($\frac{1}{38}$ of an inch). The antennules are short and seven-jointed; the first four joints are stout and subequal in length, but the remaining three are much smaller (fig. 10). The antennæ are short and stout, and the small secondary branches are two-jointed, the end joint being shorter than the other (fig. 11). The mandibles and maxillæ are somewhat similar to those of *Dactylopus rostratus*, so also are the anterior foot-jaws. The posterior foot-jaws are stout and the terminal claws are provided with a fringe of elongate spinules arranged along the inner margin in a pectinate manner, as shown by the figure (fig. 13). The first pair of swimming-feet are moderately stout; the outer branches, which are considerably shorter than the inner, have the first two joints subequal; the end joint is shorter than either of the other two, being little more than half the length of the second; the marginal spines of the three joints are stout and ciliated; the first joint of the inner branches is about one and a half times the entire length of the outer branches, and the end joint, which is very short, is armed with a stout claw, having a comb-like row of elongate spinules along the exterior edge somewhat similar to those on the terminal claw of the posterior foot-jaws; the inner branches appear to be only two-jointed (fig. 14). The following three pairs of swimming-feet are somewhat similar to those of *Dactylopus rostratus* (fig. 15). In the fifth pair the inner produced part of the basal joint is broadly rounded and provided with five terminal setæ, four of which are moderately elongate, and one—the second from the inside—very short; the secondary joint is ovate in outline and about one and a half times longer than broad, and is furnished with six moderately long setæ—one on the inner margin, three on the outer margin, and two, somewhat longer than the others, at the apex (fig. 16). The caudal stylets are shorter than the last abdominal segment.

Male unknown.

Hab. Near the head of Loch Fyne: apparently rare.

Remarks.—This species was obtained early in 1896 among some “refuse” trawled between Lowburn and Cairndow, near the head of Loch Fyne. The remarkable series of comb-like spinules on the terminal claws of the first pair of swimming-feet arrested the attention at the very outset; the creature had only to be turned on its side under the microscope to bring this character prominently into view; on dissecting the animal it was found that the terminal claws of the posterior foot-jaws were also furnished with a similar series of spinules: these peculiarities in the armature of the appendages referred to, along with differences in the structure of the antennules and of the fifth pair of thoracic feet, separate this from any other species of *Dactylopus* known to us. We would also point out that, though this species has many of the characters of a true *Dactylopus*, the structure of the first pair of swimming-feet is somewhat abnormal—for example, the middle joint of the outer branches is scarcely longer than the first, while the inner branches are apparently only two-jointed; and it may hereafter, for this reason, be considered necessary to remove it to another genus, but meantime we prefer to leave it where it is.

Eurynotus * *insolens*, gen. et sp. n.
(Pl. X. fig. 17; Pl. XI. figs. 5–13.)

Description of the Female.—Length .8 millim. ($\frac{1}{30}$ of an inch). Body robust; the thorax seen from above is broadly ovate and indistinctly divided into two unequal segments, the division of the segments being indicated by a slight flexure on each side; the anterior segment is about two thirds the length of the other and slightly wider; the forehead is broadly and more or less evenly rounded. The abdomen is composed of four segments; the first is somewhat dilated, but the others are comparatively slender, and the caudal stylets are about equal in length to the last abdominal segment; the entire length of the abdomen and caudal stylets is scarcely equal to half the length of the thorax (Pl. XI. fig. 5). The antennules are seven-jointed, short and stout, and taper gradually towards the extremity; the second joint is much longer than any of the others, and besides being furnished with several small hairs it carries a long plumose seta near the distal end of the lower margin (Pl. XI. fig. 6). The following are the proportional lengths of the joints—

Proportional lengths of the joints..	28	48	20	14	10	7	10
Number of the joints	1	2	3	4	5	6	7

* Gr. *Εὐρύνωτος*, having broad shoulders.

The antennæ are stout and apparently four-jointed, and are provided with several terminal setæ; two of these setæ are elongate and slightly hooked, while other two terminate in what appear to be rounded disks, as shown by the figure (Pl. XI. fig. 7); the antennæ do not appear to be furnished with secondary branches. The mandibles are elongate slender appendages that terminate in hook-like extremities and are furnished interiorly near the middle with two long marginal setæ (Pl. XI. fig. 8). The maxillæ are very rudimentary, each being little more than a short stout tubercle bearing two small hairs (Pl. XI. fig. 9). The anterior foot-jaws, which are also rudimentary, are short, stout, and somewhat triangular in outline, and are one-jointed and provided with two terminal setæ (Pl. XI. fig. 10). The posterior foot-jaws are apparently two-jointed, the first joint being comparatively large and dilated interiorly, so as to assume a gibbous form and having a considerable portion of the interior surface clothed with minute spines; the second joint is very small and armed with three unequal setæ, as shown by the figure (Pl. XI. fig. 11). So far as can be made out there appear to be only three pairs of thoracic feet; the first and second pairs are somewhat similar in structure; the basal joints of each foot are two in number and very stout, the second of the two basal joints carries two branches, which are comparatively wide apart; the inner branches are composed of two and the outer of three joints, and both are moderately slender; the armature of the inner branches consists of three terminal setæ, the exterior one being short, while the other two are elongate and plumose; four elongate setæ spring from the inner margin of the outer branches, one from the second joint and three from the last; the exterior marginal setæ are short (Pl. XI. fig. 12). The third pair of feet are apparently only one-branched, the outer branches being developed, while the inner are obsolete; these outer branches are two-jointed and articulated to the upper part of the distal extremity of the stout second basal joints (Pl. XI. fig. 13). There appear to be no fourth or fifth pairs. The ovisacs form elongate cylinders and appear to contain a single series of large ova. Situated between and a little in front of the mandibles is a large circular appendage, which from its peculiar structure is probably a sucking-disk for enabling the Copepod to adhere more securely to the creature that forms its host; but whether that is its only function we are unable to say. This appendage is represented by figure 17, Pl. X.

Male unknown.

Hab. Kilbrennan Sound, Firth of Clyde, 1886; apparently rare.

Remarks.—The Copepod of which the above is a description does not resemble any described species known to us; we are also unable for the present to ascribe it to any known genus, and the name we have applied to it refers to its somewhat anomalous structure and position. The peculiar form of the thorax of this Copepod was the feature that first attracted attention to it, and the subsequent examination and dissection of it revealed the abnormal character of the species. It is a Copepod that appears to be either a parasite or a commensal.

EXPLANATION OF THE PLATES.

PLATE X.

Stephos Fultoni, sp. n.

- Fig.* 1. Female, lateral view, $\times 40$. 2. Female antennule, $\times 76$. 3. Antenna, $\times 63$. 4. Mandible and palp, $\times 95$. 5. Anterior foot-jaw, $\times 95$. 6. Fifth pair of thoracic feet, female, $\times 304$. 7. Abdomen of female, $\times 80$. 8. Abdomen of male, $\times 80$.

Dactylopus pectinatus, sp. n.

- Fig.* 9. Female, dorsal view, $\times 64$. 10. Female antennule, $\times 190$. 11. Antenna, $\times 304$. 12. Anterior foot-jaw, $\times 304$. 13. Posterior foot-jaw, $\times 380$. 14. Foot of first pair of swimming-feet, $\times 250$. 15. Foot of fourth pair, $\times 120$. 16. Foot of fifth pair, $\times 380$.

Eurynotus insolens, gen. et sp. n.

- Fig.* 17. Sucker-disk.

PLATE XI.

Stephos Fultoni, sp. n.

- Fig.* 1. Foot of first pair of swimming-feet, $\times 125$. 2. Foot of second pair, $\times 125$. 3. Foot of fourth pair, $\times 125$. 4. Fifth pair of thoracic feet, male, $\times 152$.

Eurynotus insolens, gen. et sp. n.

- Fig.* 5. Female, dorsal view, $\times 80$. 6. Antennule of female, $\times 190$. 7. Antenna, $\times 304$. 8. Mandible, $\times 380$. 9. Maxilla, $\times 760$. 10. Anterior foot-jaw, $\times 304$. 11. Posterior foot-jaw, $\times 380$. 12. Foot of first pair of swimming-feet, $\times 190$. 13. Foot of third pair, $\times 190$.

XXX.—On Two new Species of Slugs of the Genus *Microparmarion* from Borneo. By WALTER E. COLLINGE, F.Z.S., Assistant Lecturer and Demonstrator in Zoology and Comparative Anatomy, Mason University College, Birmingham.

[Plate IX.]

I HAVE recently received, through the kindness of Mr. Hugh Fulton, specimens of three slugs collected at Lombok, Borneo, by Mr. A. H. Everett, making the third series I have had the privilege of examining from the Malay Archipelago*.

Quite recently I have described two new species of *Parmarion* from Lombok†, one of which—*P. intermedium*—seems to form a connecting link between the genus *Parmarion* and Simroth's genus *Microparmarion*. The two species here described are probably referable to this latter genus.

There seems little doubt but that most of the species described as *Parmarion*, *Microparmarion*, and *Girasia* will have to be included in the genus *Girasia* (emend.), in which case *Microparmarion*, Simr., would form a subgenus or section. Before any such revision can be attempted, the various species of *Girasia* described by Godwin-Austen will require more fully diagnosing, especially the anatomy of the generative organs.

Having further material from India &c. awaiting examination, I hope later to be able to give a detailed account of the anatomy of these and allied genera.

I take this opportunity of again appealing to those naturalists who are in a position to collect material to lend their kind assistance.

Microparmarion Fultoni, sp. n.
(Pl. IX. figs. 1–5.)

Shell oval in outline, convex dorsally, thick, with membranaceous borders, which are covered by the mantle-lobes, apex obscure; colour brownish amber dorsally, somewhat whitish on the ventral side. Lines of growth clearly marked. Major diam. 16 millim.; minor diam. 11 millim.

Animal almost black, excepting beneath the mantle and at the sides of the body. Mantle-lobes black, anterior lobe larger on the right side than the left, possibly due to con-

* Proc. Zool. Soc. 1895, pp. 241–250, pls. xi.–xiv.; 1897, p. 778.

† *Ibid.* 1897, pp. 778–781, pl. xlv.

traction. Posterior portion of the body conspicuously overhangs the caudal mucous pore (Pl. IX. fig. 2). Rugæ faintly marked, elongated posteriorly. Peripodial groove distinct. Foot-fringe and lineoles black. Foot-sole divided into median and lateral planes, the latter being almost black and the former yellow in colour. Caudal mucous pore a vertical slit, which appears to extend to the foot-sole, such appearance being caused by a little groove which is bounded on each side by the foot-fringe (Pl. IX. fig. 1, *b*), which extends halfway up the sides of the body (Pl. IX. fig. 2). The sides of the mucous pore are almost black.

Length (in alcohol) 32 millim.; breadth of foot-sole in anterior region 5.5 millim.

Hab. Lombok (1500 feet), Borneo (*A. H. Everett*).

I have much pleasure in associating with this interesting form the name of Mr. Hugh Fulton, who has so kindly placed the material in my hands.

Anatomy of the Generative Organs.

The vestibule opens into the vagina, which is a wide and almost straight tube. At its upper portion an almost ductless receptaculum seminis opens; it is somewhat pyriform in shape, reminding one of the condition which obtains in *Parmarion intermedium*, Collge. (Pl. IX. figs. 3 & 4, *r.s.*). The penis exhibits two constrictions, which divide it into three portions, viz. a beak-shaped head, with a narrower portion below, and a globose proximal portion. The vas deferens passes off from the ventral side of the beak-shaped portion as in *Parmarion intermedium*, the retractor muscle having its attachment to the middle division. The free oviduct is a large wide tube expanding just before it joins the common duct, which latter is densely folded. The albumen-gland is large and peculiar in shape (Pl. IX. fig. 3, *alb.gl.*) and of an orange-red colour. The hermaphrodite gland is a comparatively large glandular body hidden in the liver and attached to the hermaphrodite duct, a long unconvoluted tube. The dart-sac (Pl. IX. fig. 3, *d.s.*) is a large thin-walled organ, exhibiting a slight enlargement at its proximal end and a fusiform head constricted off from the main arm at its distal end. Externally this upper portion was finely reticulated; whether or not this was due to the alcohol I cannot say. The dart (Pl. IX. fig. 5) is quite distinct in shape from that of any other species I am acquainted with; it consists of a fusiform head and an elongated and almost circular lower portion, narrowing slightly at its base. It is solid throughout, non-calcareous, and has no opening or slit.

Affinities.

Externally this species is not unlike a small example of *Parmarion intermedium*, Cllge., to which it is undoubtedly closely related. It possesses the same characters in the form of the penis as are common to *P. pupillaris*, Humb., *P. Weberi*, Simr., *P. Martensi*, Simr., *P. intermedium*, Cllge., *P. Everetti*, Cllge., and other species, viz. division into three portions, the third or distal one being beak-shaped. The peculiar shaped solid dart is unlike that of any other species of *Microparmarion* or *Parmarion*.

Microparmarion constrictus, sp. n.
(Pl. IX. figs. 6, 7.)

Externally this species is not unlike *Parmarion intermedium*, Cllge.; it differs, however, from that species in its smaller size, slightly lighter colouring, the smaller size of the mantle-lobes, and the lighter lateral planes of the foot-sole. Godwin-Austen* has previously drawn attention to the few distinguishing characters in the outward appearance of the species belonging to the genus *Parmarion*, and these apply with equal force to the species of *Microparmarion*.

Length (in alcohol) 35 millim.

Hab. Lombok (1500 feet), Borneo (*A. H. Everett*).

Anatomy of the Generative Organs.

The sessile receptaculum seminis at once indicates this species to belong to Simroth's genus *Microparmarion*. The penis (Pl. IX. fig. 6, *p.*) commences as a large bulbous organ, which forms the first division; the second portion is as in other species where the three divisions obtain, while the third terminates in a blunt beak-shaped head. The retractor muscle is attached to the inner side of the third division. The vas deferens passes off from the third division of the penis, slightly above the point of separation between the second and third divisions. The free oviduct, as in most species of *Microparmarion*, is short. The dart-sac is peculiar in form, being much folded and twisted upon itself (Pl. IX. fig. 6, *d.s.*); when unfolded it is as represented in figure 7. There was no dart present in the sac, which probably accounts for the manner of folding &c.

Affinities.

There seems to be little relation between this and any of

* Ann. & Mag. Nat. Hist. 1895, vol. xvi. pp. 434-437, pl. xix.

the known species. Should further specimens be obtained a more complete knowledge of the generative anatomy may throw further light on the subject. It is also desirable that the form and nature of the dart should be known.

With the above two species there is a small specimen, 26 millim. long, externally not unlike *M. constrictus*, but with a more ovoid shell, and it has both the median and lateral planes of the foot-sole the same colour—a bright yellow, I should think—in life. The internal organs were not in a very good condition, so for the present I am regarding it as a small example of *M. constrictus*.

I understand that Mr. Fulton will present the three specimens to the British Museum (South Kensington).

EXPLANATION OF PLATE IX.

- Fig. 1.* *Microparmarion Fultoni*, sp. n. Caudal mucous pore. *a*, slit-like pore; *b*, groove passing through the foot-fringe; *c*, sides of body; *d*, foot-fringe; *e*, lateral planes of foot-sole; *f*, median plane of foot-sole. The peripodial groove being inconspicuous, it is not shown in this figure.
- Fig. 2.* View from the right side of the terminal portion of the body.
- Fig. 3.* Generative organs.
- Fig. 4.* Receptaculum seminis.
- Fig. 5.* The dart.
- Fig. 6.* *Microparmarion constrictus*, sp. n. Generative organs.
- Fig. 7.* Dart-sac unfolded.

Lettering.

<i>alb.gl.</i> Albumen-gland.	<i>pr.</i> Prostate.
<i>d.s.</i> Dart-sac.	<i>r.m.</i> Retractor muscle.
<i>f.ov.</i> Free oviduct.	<i>r.d.</i> Receptacular duct.
<i>h.d.</i> Hermaphrodite duct.	<i>r.s.</i> Receptaculum seminis.
<i>h.gl.</i> Hermaphrodite gland.	<i>v.</i> Vestibule.
<i>ov.</i> Oviduct.	<i>v.d.</i> Vas deferens.
<i>p.</i> Penis.	<i>vg.</i> Vagina.

XXXI.—*A brief Bibliographical Résumé of the Erythraean Molluscan Fauna, with Descriptions of Sixteen Species from Aden.* By JAMES COSMO MELVILL, M.A., F.L.S.

[Plate XII.]

THE greater number of the marine shells dredged or otherwise collected by Commander E. R. Shopland, R.I.M., mostly in the immediate neighbourhood of Aden, have already been catalogued by him in a paper* read before the Bombay Natural

* Shopland, E. R., "List of Shells collected at Aden, 1892-95," Journ. Bombay Soc. x. pp. 217-235.

History Society in January 1896, with a supplement published a few months afterwards*. The main list contains 547 names, the appendix 57, making a total of 604.

A considerable residuum, however, existed undifferentiated, and this has been kindly placed by Commander Shopland in my hands for examination.

I do not propose within the limits of the present paper to do more than describe and figure certain new forms, in the hope that in due time the catalogue just mentioned will be still further amplified and extended by its author, so as to include all additions to date. By thus doing, 40 or 50 more names could now be added, making the very respectable total of over 650 species.

In the meantime it may be well, at the outset, to touch briefly on the fauna of Aden and contiguous seas, so as to present at a glance a *résumé* of the work already done, and a record of the investigators who were chiefly instrumental in carrying out the task of elucidating the varied forms of marine Mollusca native in the Red Sea and off the Arabian coasts.

The names of Niebuhr (1761), Forskål (1771), Brocchi (1819), Savigny (1825), Ehrenberg and Hemprich (1820-31), and Rüppell (1828) stand out prominently as the pioneers of investigation in Egypt, Suez, and the Red Sea, and they in turn were followed by Laborde and Linant† (1830), L. Pfeiffer (1846), Jonas (1846), Vaillant (1865), and E. von Martens (1866), the latter describing the collections made by the well-known Eastern traveller Dr. E. Schweinfurth two years previously in the Red Sea.

Especial mention must be made of Arturo Issel‡, in whose enumeration of Erythræan Mollusca 573 recent species, including many novelties, which are mostly figured, are given. A separate catalogue embraces the fossil forms. An appendix containing the recent species quoted in Paetel's Berlin Catalogue as natives of the Red Sea, not, however, found by Issel, is printed, giving 67 additional names, thus forming a grand total of 640.

This, curiously enough, almost exactly tallies with the number, as given above, in Commander Shopland's Aden lists, a coincidence which may be significant, as tending to show a probable equalization, numerically speaking, in both centres of investigation, *i. e.* the Red Sea without Aden, and Aden and the contiguous shores of the province of Yemen.

* *T. c.* pp. 503, 504.

† 'Voyage de l'Arabie Pétrée': Paris, 1830.

‡ 'Malacologia del Mar Rosso, ricerche zoologiche e paleontologiche di A. Issel': Pisa, 1869.

Again, in Mr. Robert MacAndrew's Report * on the Mollusca of the Gulf of Suez (republished 1885, with additions and corrections, by the Rev. Alfred H. Cooke †, of Cambridge), 608 species are finally admitted as distinct, as against Mr. MacAndrew's own estimate of 818.

Here, again, is a remarkable consensus of figures.

In 1870 Issel and Tapparone-Canefri monographed the Strombidæ, in 1875 the latter (Tapparone-Canefri) the Muricidæ, of the Red Sea; and C. F. Jickeli enumerated 45 Mitridæ and 34 species of *Conus* from the same waters, of which the most interesting are *Mitra Hemprichii*, Issel, *Conus schech*, Jick., and *Conus Jickelii*, Weink.

Dr. F. Jousseume has of late years personally collected on these shores, and has been successful in discovering many new and some doubtful forms, to which he has given descriptions. It might be wished by some that he would not attempt so minute a subdivision of genera without sufficient cause, as in *Cypræa*, for instance. Not having seen any of the following genera propounded by this author ‡ in 1894 from Aden and the Red Sea, I cannot pronounce upon them:—*Kyrina*, *Extra*, *Djeddilia*, *Stolida*, *Agagus*, *Psammosphærita*. The name *Extra extra*, given to a shell with some unusual attribute of beauty, thus fatal to itself, should be disallowed as offending nearly all the canons of the laws of nomenclature. *Stolida avalitensis*, from Aden, apparently is a *Strombus*. *Agagus agagus*, from the Gulf of Aden, is, by the description, too imperfectly defined to be placed in any family, through lack of a figure. *Djeddilia djeddilia*, another curious duplication, is also in the same unfortunate position.

In 1888 the same author published a list of mollusks collected by Dr. Faurot § in the same localities (Red Sea and Gulf of Aden), 218 species in all.

Signor G. Caramagna, in the same year (1888), published a list || of South-Arabian species, mostly from Assab, with ten new species described, mostly belonging to the Turbinidæ and Trochidæ.

In June 1891 Mr. Edgar A. Smith's paper entitled "Notes

* "Report on the Testaceous Mollusca obtained during a Dredging Excursion in the Gulf of Suez, Feb. and March, 1869," by R. MacAndrew, Ann. & Mag. Nat. Hist. ser. 4, Dec. 1870, pp. 429 sqq.

† Part I., Ann. & Mag. Nat. Hist. 1885, xv. pp. 322 sqq.; Part II., 1885, xvi. pp. 31 sqq.; Part III., 1885, xvi. pp. 262 sqq.

‡ F. Jousseume, "Diagnoses des Coquilles de nouveaux Mollusques," Bull. Soc. Philom. vi. pp. 98-105.

§ Mém. Société Zool. de France, i. pp. 165-223.

|| "Catalogo delle Conchiglie Assabesi," Bull. Soc. mal. Ital. xiii. pp. 113-149, pl. viii.

on a Collection of Marine Shells from Aden, with some Remarks upon the Relationship of the Molluscan Fauna of the Red Sea and Mediterranean," was read* before the Zoological Society of London, being founded on gatherings made by Major † J. W. Yerbury, R.A., and the Rev. A. W. Baynham.

This was, up to the time of its issue, by far the most complete list that had been compiled, and the author praiseworthy rendered it more perfect still by appending the species mentioned (*a*) by Dr. Jousseaume, (*b*) by Caramagna, which had not been noticed by either Major Yerbury or Mr. Baynham.

These latter collected 269 species, and 83 are enumerated in (*a*) and (*b*), making a total of 352 in all.

Commander Shopland's collections nearly double this number, and it may therefore be said, without fear of contradiction, that this experienced investigator can claim to have done more than any of his predecessors towards rendering such a catalogue complete. Most of his specimens have been dredged—it would be impossible to make satisfactory gatherings otherwise; and I can only express the earnest hope that before many years have elapsed as assiduous a malacologist may examine the shores and seas impinging on the Hadramaut and Dhofar districts of South Arabia as far as Muscat in the east, for I am not aware that any work to speak of has been carried out in those localities.

Further east, from Muscat, including the Persian Gulf, along the Mekran coast of Baluchistan, to Karachi, Mr. F. W. Townsend, of the Indo-Oceanic Telegraph Service, has for the past five years been engaged in dredging wherever opportunity offered, and the results have been published in papers by Mr. G. B. Sowerby ‡, and latterly by the writer §, many novelties occurring. Mr. Townsend has hardly yet essayed the 100-fathom line—indeed, 75 fathoms seems to be the greatest depth he has yet attained; but it is hoped he will be able to effect this desirable end shortly, and so aid in removing the reproach uttered by Dr. Günther, F.R.S., in the last annual Presidential Address to the Linnean Society ||, when, speaking of the various deep-sea explorations over the various marine areas of the world, he remarks:—"We know nothing whatever of the sea to the west of the Laccadives or of the north-western part of the Arabian Sea."

* Proc. Zool. Soc. 1891, pp. 390 *seqq.*

† Now Lieut.-Colonel.

‡ Proc. Mal. Soc. Lond. i. pp. 160, 161, and pp. 278-280.

§ Mem. Manch. Soc. vol. xli. part iii. 1897, &c.

|| Proc. Linn. Soc. 1896-97, p. 46.

Nearly all the following species have been examined by Mr. Edgar Smith, and to him, Mr. Hugh Fulton, and Commander Shopland I would tender my thanks for kind services rendered.

*Nassa (Hebra) polychroma**, sp. n.
(Pl. XII. fig. 1.)

N. testa ovato-fusiformi, solidiuscula, vario-picta, nunc rufo-cinerea, nunc pallidiore, nunc spiraliter ochraceo-cincta; anfractibus quinque, excluso apicali, paullum gradatulis, apud suturas impressis, supernis rufis, nodulo-cinctis, penultimo spiraliter bino nodulorum ordine decorato, nodulis sæpius nigro-cæruleis, interstitiis rufo-liratis, infra, juxta suturas spiraliter rufo et albo squarrose tessellato, ultimo anfractu similiter decorato, videlicet, quatuor nodulorum ordinibus, nodulis nitidis, interdum albidis, interdum et sæpius nigro-cæruleis, duobus apud medium ordinibus contiguis, interstitiis spiraliter rufo-liratis, et juxta basin uni- vel binigro-liratis; apertura ovata, labro extus incrassato, hic illic rufo-punctato, intus denticulato; columella rotundo-excavata, canali brevi.

Long. 14, lat. 8 mm.

A highly coloured but variably painted shell, always roundly nodulous, the nodules as a rule being painted blackish blue, shining; the prevailing ground-colour is either rufous grey or orange-rufous. In one specimen in the British Museum a beautiful spiral broad ochraceous zone surrounds the last whorl.

Several examples.

Mangilia (Glyphostoma) fenestrata, sp. n.
(Pl. XII. fig. 2.)

M. testa fusiformi, crassiuscula, rugosa, albida; anfractibus novem, tumidulis, quorum apicali lacteo, vitreo, simplici, cæteris longitudinaliter costis regularibus instructis, spiraliter rudi-liratis, interstitiis, præcipue in tribus ultimis anfractibus, sæpe profundis et cavis, ultimo dorsaliter apud peripheriam obscure calcarea zonula interrupta accincto, ad basin paullulum producto; apertura angusta, labro incrassato, intus denticulato, sinu conspicuo, lato, margine columellari versus basin bidenticulato.

Long. 6, lat. 2 mm.

Slightly resembling, in the irregular chalky-white dorsal band at the periphery of the last whorl, *M. (Glyphostoma) calcicincta*, M. & S., from Lifu, but of quite different shape. There are evidently many of this genus to be discovered.

* πολυχρώμα, many-coloured.

During the past four years from Lifu alone nearly forty species have come to light, described either by M. Hervier or by myself in conjunction with Mr. Standen, and a more exquisite series of shells could hardly be imagined, both for sculpture, pattern, and colour. The species before us would probably be considered a *Borsonia* by some authors, owing to the presence of columellar plaits or teeth; but I prefer including all in *Glyphostoma*, as every gradation is perceptible when the species are successively examined.

Coralliophila arabica, sp. n. (Pl. XII. fig. 3.)

C. testa globosa, solida, fere applanata, spiraliter, præcipue apud basin, leviter sulculosa; anfractibus quinque, supernis parvis, ultimo rapide accrescente, cæteros magnopere superante; apertura alba, rotundo-ovali, nitida, intus striata, labro extus incrassato, intus crenato, canali brevi.

Long. (spec. maj.) 24, lat. 20 mm.

A roundish, globular, thick, white species, without the slightest trace of violet either in the aperture or on the surface. It is closely and lightly transversely furrowed towards the base of the last whorl, which is so large as almost to monopolize the whole shell; the aperture is roundly oval, white, shining, striate within, outer lip thickened within, crenulate at the margin, canal short.

I think this is distinct from any form of *C. violacea*, Kien., = *neritoidea*, Ch.; indeed, it more resembles *C. retusa*, H. & A. Ad., but is of different texture, and, as before said, is white, without the slightest tinge of violet, this appearing in all the forms of *retusa* I have seen.

Aclis exæreta *, sp. n. (Pl. XII. fig. 4.)

A. testa fusiformi, versus apicem attenuata, apice vitreo; anfractibus undecim, paullum irregularibus, undique spiraliter delicatissime liratis, quinque vel sex supernis, inclusis apicalibus, parvis, sexto et septimo subito accrescentibus, tumidulis, tribus ultimis rectis; apertura ovata, labro exteriore paullum effuso, crassiusculo, aurito.

Long. 11, lat. 2.50 mm.

A most graceful shell, the whorls being in the middle slightly irregular. Eleven-whorled, of which two are apical and glassy; the sixth and seventh are tumid and more swollen than the rest; the last three are straight; the aper-

* ἐξαιρέτος, choice.

ture ovate, outer lip slightly effuse, ear-shaped, somewhat thickened. The whole surface of the shell is microscopically exceedingly finely spirally liriate.

Eulina Shoplandi, sp. n. (Pl. XII. fig. 5.)

E. testa pyramidali, aciculata, albo-lactea, nitidissima, recta, vel interdum paullum curvata; anfractibus decim vel undecim, quorum apicali vitreo, mamillato, cæteris planis, politissimis, semipellucidis; apertura ovata, labro crassiusculo, simplici.

Long. 5, lat. 1.75 mm.

Nearly thirty specimens of a very beautiful semitransparent *Eulina*, yielding to none of the other species in glassy whiteness and extreme polish, which, while possessing no very marked qualifications, does not seem to agree with any yet described. I have searched the British Museum collection thoroughly as well as my own, this last being rich in Eulimidæ, and also compared it with the descriptions and plates in the various monographs. It seems allied to *E. pyramidalis*, Ad., and *opaca*, Sow.; it is not so stout, and is smaller than either. To *E. venusta*, Pease, a much narrower shell, it has some resemblance, and also is akin to *E. pusilla*, Sowb.; but here, again, the species is larger and is always, so far as we are aware, straight. *E. Shoplandi* is occasionally incurved, though the majority of specimens before us are not so.

This genus is one of the most difficult as regards specific differentiation, especially as regards the forms with ovate mouths, and it is only after a very patient investigation, in which I have been much aided by the discoverer, after whom I have much pleasure in naming it, that I have ventured to add it to the lists.

A species, till now undifferentiated, which is probably the same as this, is found near Karachi (*F. W. Townsend*).

Leiostraca constellata, sp. n. (Pl. XII. fig. 6.)

L. testa minuta, fusiformi, vitrea, tenuissima; anfractibus octo, quorum duobus apicalibus pervitreis, cæteris planatis, apud suturas haud impressis, nitidis, circa medium infra suturas regulariter rotundis punctorum ordinibus constellatis roseis decoratis, ultimo quoque anfractu apud basin hic illie simili modo leniter compresso; apertura oblonga, labro tenui, simplici, margine columellari fere recto.

Long. 3.50, lat. 1 mm.

A most delicate and curious little Eulimoid shell; its markings are quite unlike those of any species known to

me. It is very small, fusiform, glassy, transparent, eight-whorled, including the apical, quite smooth, not impressed at the sutures, shining, and around the middle of the whorls ornamented with regular round masses composed of red dots, which also run more sparingly towards the base of the last whorl. The mouth is oblong, the outer lip thin, simple, the columellar margin nearly straight.

The label accompanying this species has, unfortunately, got mislaid, and it is possible it was found further to the east than Aden; but at all events it is an inhabitant of the North Indian Ocean (Arabian Sea).

Leptothyra yemenensis, sp. n. (Pl. XII. fig. 7.)

L. testa solidula, globuloso-conica, vix perforata, albida; anfractibus quatuor, paullum ventricosus, ad suturas impressis, ultimo rapide accrescente, undique delicate liratis, hic illic puniceo-maculatis, liris in ultimo anfractu circa sex et viginti; apertura circulari, intus alba, labro paullum effuso, columella dilatata, et apud basin producta.

Alt. 4, diam. 4.50 mm.

Not the least beautiful of the genus, abounding as it does in lovely and often brightly coloured little species. I cannot exactly match this with any of the numerous forms described. It is near *L. marmorea*, Pease, from the Hawaiian Archipelago. It differs in being slightly perforate, and the aperture not ovate but circular; the whorls, too, are hardly so sloping, and the spiral liræ are fine and more pronounced. It resembles in form some of the large Turbinidæ with strongly dilated base to the columella, e. g. *crassus*, Wood, *sparverius*, Gmel., *funiculosus*, Reeve. The fine liræ are spotted irregularly with pink, but the prevailing colour is whitish straw, these spots being very inconspicuous.

Calyptræa (Galerus) Edgariana, sp. n.
(Pl. XII. fig. 8.)

C. testa conica, pileoliformi, vertice acuto, oblique declinante, radiatim rudi-costata, costis rugosulis, concentrice striata, interiore purpurascete, apud marginem pallidiore, appendice interna parva, appressa, circiter indurata, ad latus affixa.

Alt. 8, lat. 18 mm.

Doubtless a polymorphous species like the majority of its congeners, adapting itself so as to suit any location it may have chosen. The specimen before us is to some extent covered externally with marine growth, but the rugose radia-

tion and concentric striæ are, with care, discernible. The apex is prominent, obliquely declining. Within, the surface is shining, purple, paler towards the margin. The septum is small, adpressed, and thickened both in itself and around; it is placed on the side of the apical declination.

A specimen of what is almost certainly this shell is in the British Museum, also from Aden, and is mentioned (but not named) by Mr. E. A. Smith in Proc. Zool. Soc. 1891, p. 418, differing from our example in being more elevated and not having such complete uniformity of interior purple coloration, but otherwise similar. Named in honour of Mr. Edgar Smith.

Novaculina xyreces *, sp. n. (Pl. XII. fig. 9.)

N. testa cylindrico-elongata, inæquilaterali, utrinque bisulca, alba, epidermide olivacea rudi contacta, ad medium plerumque detrita; umbonibus parvulis, contiguis; margine dorsali postice recto, producto, denique ovato-rotundato, antice leniter declivi, rotundato, margine ventrali fere recto; intus pagina alba, nitida, sinu palliali profundo.

Alt. 15, lat. 32, diam. 8 mm. (spec. majoris).

An ordinary-looking mollusk, but not agreeing exactly in form with *N. gangetica*, Benson, or the few other described species. We have no particulars of the exact habitat, but no doubt it was found in like situations as the others of this genus in the mud of fluviatile estuaries. It is posteriorly a very elongated shell, more or less covered with a dirty olivaceous epidermis, more rounded anteriorly, and has an almost straight ventral margin. The valves gape at both extremities.

Tellina (Tellinella) manumissa †, sp. n.
(Pl. XII. fig. 10.)

T. testa oblonga, crassiuscula, paullum inæquilaterali; umbonibus parvis, rectis, dorsaliter utrinque leniter declivi; antice rotundata, postice oblonga, marginem apud ventralem paullum convexa, extus, superficie albida, a dorso centrali ventralem usque ad marginem pulcherrime roseo-suffusa, spiraliter delicate striata, sub lente striis longitudinaliter decussatis, apud margines fere evanidis; intus pagina in medio rosea, circiter albo-marginata, linea palliali angulatim ad medium adscendente.

Alt. 1·50, lat. 2·50, diam. ·25 unc.

* ξυρήκης, keen, as a razor.

† *Manumissa*, set free.

Hab. Aden (Capt. E. R. Shopland and Major J. W. Yerbury).

A fine and critical species. It is to Captain Shopland and Mr. Edgar Smith I am indebted for first pointing out the differences between it and *T. madagascariensis*, Gmel. Though, looking cursorily, they might at first be considered identical, they differ in several important particulars, *e. g.* :—

<i>T. madagascariensis.</i>	<i>T. manumissa.</i>
i. Substance thick.	Of thinner texture than its congener.
ii. Posteriorly rostrate.	Posteriorly simply oblong.
iii. Plainly spirally striate.	Plainly spirally striate, and likewise longitudinally microscopically striato-decussate.
iv. Within, entirely red.	Within, red centrally, but white-margined.
v. Pallial line at a wider and more extended angle.	Pallial line at a higher and more acute angle.

There likewise exists a slight similarity to *T. planata*, L., from the Mediterranean, and to *T. strigosa*, Gmel.

The fine example collected by Major Yerbury is now in the British Museum, and was catalogued by Mr. E. A. Smith as *madagascariensis* (Proc. Zool. Soc. 1891, p. 426).

Tellina (Angulus) yemenensis, sp. n.
(Pl. XII. fig. 11.)

T. testa inæquilaterali, convexa, ovato-oblonga, antice rotundata, postice angustata, albo-rosea; umbonibus approximatis, depressis, parvis; valvis nitentibus, iridescentibus, arcute et delicatissime concentrico-striatis; margine dorsali antice leniter rotundato-declivi, postice rectiuscule-descendente, margine cum ventrali angulum fere acuminatum formante; intus superficie albescente, vel albo-rosea, vel omnino rosea, præcipue versus umbones, sinu palliali extenso profundo.

Long. (sp. maj.) 13, alt. 10, diam. 3.50 mm.

Much resembling *T. corbuloides*, Hanley, with which I at first deemed it identical. A closer inspection, however, decided me that it was altogether distinct. The surface is, to begin with, iridescent, altogether more shining than *corbuloides*, the umbones in this last being more prominent and larger and the anterior slope of the dorsal margin slightly more rounded. The angle formed at the junction of the oblique dorsal posterior slope with the ventral margin is more acuminate and the ventral margin itself sinuoso-convex. Several specimens, which differ mainly in colour, some being

only tinged towards the umbones with rose, while others are whitish, and a third flesh-colour.

Specimens exist, unnamed, in the British Museum.

Gari amianta *, sp. n. (Pl. XII. fig. 12.)

G. testa oblonga, æquivalvi, fere æquilaterali, tenui; valvis utrinque hiuleis, albidis, nitidis, superficie irregulariter concentrice striata striis rudibus, sed tenuibus; umbonibus prominulis, approximatis rectis; margine dorsali postice paullulum excavato, antice levi declivi, prolongato, ventrali fere recto; intus albescente, nitida linea palliali apud medium extensa, profunde sinuosa; cardin valvæ sinistræ dente uno simplici, dextræ dente bifido prædito.

Alt. 18, lat. 28, diam. 5 mm.

A pure white shell, equivalve and almost equilateral, thin, in form showing some affinity to certain *Psammotellæ*, e. g. *Rüppelliana*, Reeve, from the Red Sea, but possessing no callosity of the hinge-margin and no trace of violet colour. The surface of the valves is finely but rudely and irregularly concentrically striate, the umbones are approximate, prominent; dorsal margin slightly excavate on the posterior side, which is prolonged, and on the anterior more gradually sloping, the ventral margin being straight. The valves gape both posteriorly and anteriorly; the hinge of the left valve has one simple tooth, which is bifid in the right valve. Within, the surface is white, shining, the pallial line deeply sinuous and extending to the middle of each valve.

Petricola lyra, sp. n. (Pl. XII. fig. 13.)

P. testa inæquilaterali, rudi, albida, tenui; umbonibus niveis, politis; valvis tumidulis, parum hiantibus, extus irregulariter radiatim costatis, costis acutis, carinulatis, apud medium distortis vel deviis; postica carina magna, acuta, interstitiis transversim rudilatis, liris remotis, antice rotundata, margine ventrali convexiusculo; intus alba, nitida; impressione musculari postica rotunda, magna, cardinibus tridentatis, linea palliali conspicua, sinuosa.

t. 12, lat. 15, diam. 7 mm.

A *Petricola* with a certain attempt at regularity of outline and symmetry of ten radiate, acutely keeled, ribs, the last rib on the posterior side being in both valves especially conspicuous and well defined, while the anterior ribs are more distant. Concentrically the surface is remotely lirate, the

* ἀμίαντος, pure, unsullied.

umbones are shining, pure white; dorsal margin rather sloping, anterior rounded, ventral slightly convex; valves both equally tumid. Within, the surface is white, the impression of the posterior adductor muscle is large and round, the pallial line deeply sinuous posteriorly.

Far more conspicuously ribbed and acutely keeled than *P. Hemprichii*, Issel, which is the prevailing form at Aden (cf. A. Issel, *Mal. del Mar Rosso*, 1869, pp. 61, 62, pl. i. fig. 6). This latter species, indeed, is not far removed from, if not absolutely identical with, the common Mediterranean form, *P. lithophaga*, L.

Semele Shoplandi, sp. n. (Pl. XII. fig. 14.)

S. testa nitida, albida, tenui, breviter ovata, lunula angusta, oblonga; umbonibus parvis, lævibus; margine dorsali utrinque declivi, postice subtruncato, antice ovato; margine ventrali rotundo-convexo, superficialiter fere lævi, concentrice bi- vel tri-zonulato, et leniter decussato vel sculpto; intus albo-lactea, nitida, sinu palliali conspicuo, extus medium extenso.

Alt. 26, lat. 28, diam. 13 mm.

A pure white delicate species with inconspicuous umbones and oblong narrow lunule, the dorsal margin sloping rapidly on both sides, posteriorly subtruncate and ovate anteriorly, the ventral margin rounded, convex. Within, the shell is white, the pallial line possessing a conspicuous sinus extending to the middle of the shell. The outer surface is smoothish, rather shining, white, concentrically twice or thrice rudely banded; under a lens the whole surface is thinly decussate with scratched lines.

Superficially only allied to *S. cordiformis*, *chinensis*, &c., the valves being smoother than in any other Eastern species.

Pectunculus tegulicius *, sp. n. (Pl. XII. fig. 15.)

P. testa æquilaterali, fere rotunda, incrassata, convexiuscula, sordide cinerea, hic illic maculis rufis interspersis; umbonibus obliquis: radiatim fortiter costata, costis arctis, quatuor et viginti, imbricatis et transversim crassi-squamatis, interstitiis angustis, squamis rudibus similiter instructis; cardine dentibus triginta in valva utraque prædito, interiore albescente, rufo-sparso.

Alt. 18, lat. 20, diam. 13 mm.

A very interesting form, though, perhaps, not quite mature,

* *Tegulicius*, of, or pertaining to, a tiled roof.

but possessing essential characters of its own. The shell is equilateral, equivalve, almost round; umbones slightly oblique; surface of a dull drab colour, here and there relieved by bright brown spots or blotches, with about twenty-four closely grained or scaly costæ; these ribs are rather broad for the size of the shell, and the interstices are narrow, very rudely spirally scaled in a similar way to the ribs. The hinge-teeth are whitish, about thirty in number; the interior is whitish, spotted and stained in places with rufous brown.

Thracia adenensis, sp. n.
(Pl. XII. fig. 16.)

T. testa trapezoide, albida, papyracea, tenui, concentrice irregulariter striata, parum nitida; umbonibus prominulis; valva dextra sinistræ marginem ventralem superimpendente, majore et convexiore, ab umbonibus ad extremitatem marginis ventralis posticam unicarinata, sinistra simili carina prædita; pagina interna albo-lactea, haud nitida, lævi; cicatrice anteriore oblonga, postica squarrosa, latiore, sinu palliali profundo.

Long. 28, alt. 19, diam. 8 mm.

A pure white papyraceous shell, extremely truncate posteriorly, with conspicuous umbones, that of the right valve superimpending its fellow, just as the right ventral margin overhangs that of the left. The right valve is more convex, but the left is not so flattened as in some *Thraciæ*; a conspicuous oblique keel in both valves extends from the umbones to the lower posterior margin.

EXPLANATION OF PLATE XII.

- Fig. 1. *Nassa (Hebra) polychroma.*
- Fig. 2. *Mangilia (Glyphostoma) fenestrata.*
- Fig. 3. *Coralliophila arabica.*
- Fig. 4. *Actis exæreta.*
- Fig. 5. *Eulima Shoplandi.*
- Fig. 6. *Leiostraca constellata.*
- Fig. 7. *Leptothyra yemenensis.*
- Fig. 8. *Calyptræa (Galerus) Edgariana.*
- Fig. 9. *Novaculina xyreces.*
- Fig. 10. *Tellina (Tellinella) mammissa*
- Fig. 11. *Tellina (Angulus) yemenensis.*
- Fig. 12. *Gari amianta.*
- Fig. 13. *Petricola lyra.*
- Fig. 14. *Semele Shoplandi.*
- Fig. 15. *Pectunculus tegulicius.*
- Fig. 16. *Thracia adenensis.*

XXXII.—*Descriptions of some new Species of Heterocera.*

By HERBERT DRUCE, F.L.S. &c.

Fam. *Ægeriidæ*.*Sciapteron Meeki*, sp. n.

Male.—Primaries bright purplish blue, the costal and outer margins edged with black, the underside almost brighter than the upperside: secondaries hyaline, with a large metallic-blue marking from the base extending to the end of the cell and below the cell nearly to the outer margin; the outer and inner margin edged with black; the fringe of both wings black. The antennæ, head, thorax, abdomen, and legs black; the collar and palpi yellow; anal tuft black.

Expanse $1\frac{1}{2}$ inch.

Hab. Trobriand Islands, Kiriwini (*A. S. Meek, Mus. Druce*).

This species is allied to *S. pulchripennis*, Walk., from which it is at once distinguished by its much brighter colour, narrower black margins to the primaries, and several minor differences.

Fam. *Syntomidæ*.*Pseudosphenoptera triangulifera*, sp. n.

Male.—Primaries black, shot with bright metallic green from the base to beyond the middle; a narrow hyaline streak at the base on the costal margin, below which is a round hyaline spot; the fringe black: secondaries deep black, with a small hyaline spot close to the base. On the underside both wings shot with dark blue at the base. Antennæ black; the head, thorax, and abdomen black, thickly irrorated with metallic-blue scales; abdomen with two white spots at the base and a row of white spots on each side; legs black, tipped with white.

Expanse $1\frac{1}{4}$ inch.

Hab. Amazons (*Mus. Druce*).

Desmidocnemis thyria, sp. n.

Male.—Primaries and secondaries yellowish hyaline, all the veins black; primaries with the costal, outer, and inner margins narrowly edged with black: secondaries black at the

apex and partly along the outer margin. The antennæ, head, thorax, and legs black; the abdomen greenish black.

Expanse $1\frac{1}{10}$ inch.

Hab. Ecuador, Balsapamba (*Mus. Druce*).

Chloropsinus nox, sp. n.

Female.—Primaries and secondaries uniformly dull brownish black; primaries with two small metallic-green spots close to the base; the fringe of both wings black. Underside very similar to the upperside, but the primaries with a bluish-grey streak from the base to the end of the cell. The antennæ black, tipped with white; head black, spotted with metallic green; thorax, abdomen, and legs brownish black, abdomen with a metallic-green spot at the base.

Expanse $1\frac{1}{2}$ inch.

Hab. Ecuador, St. Lucia (*Mus. Druce*).

Agyrta monoplaga, sp. n.

Male.—Primaries black, shot with blue at the base and along the inner margin; a wide whitish hyaline band crosses the wing about the middle from the costal margin almost to the apex: secondaries black, shot with bright blue at the base and along the inner margin. Antennæ black; the head red; thorax and abdomen dark bright blue; front of the head and underside of thorax white; the legs bluish black.

Expanse $1\frac{4}{10}$ inch.

Hab. Ecuador, Balsapamba (*Mus. Druce*).

Pseudaclytia umbrica, sp. n.

Male.—Primaries pale brown, darkest at the base and partly along the costal margin: secondaries darker brown except along the costal margin. The underside of both wings very pale brown. The head, antennæ, thorax, and base of abdomen pale brown, the abdomen black above, the underside and the legs brownish white, the sides of the abdomen and anal tuft yellow.

Expanse $1\frac{1}{10}$ inch.

Hab. Brazil, Cabo (*Forbes, Mus. Druce*).

Fam. *Laparidæ*.

Lymantria mosera, sp. n.

Male.—Primaries pale brown, crossed about the middle by a wide white band, which becomes quite narrow near the

inner margin; the veins crossing the white band are pale brown, the fringe pale brown: secondaries pale yellow, slightly darker along the inner margin. The head and thorax pale brown; abdomen darker yellow than the secondaries; antennæ black.

Expanse $1\frac{1}{2}$ inch.

Hab. East Africa, Delagoa Bay (*Mus. Druce*).

Both sexes of this species are in the National Collection; the female is considerably larger than the male, but in other respects it is very similar.

Lymantria Thomsoni, sp. n.

Female.—Primaries pale brownish fawn-colour, with a large silvery-white spot at the end of the cell, beyond which are several small silvery-white dots; the fringe pale brown: secondaries semihyaline brownish white. The head, thorax, and abdomen pale brownish fawn-colour.

Expanse $2\frac{1}{4}$ inches.

Hab. West Africa, Mongo-ma-Lobah (*Mus. Druce*).

Lymantria hera, sp. n.

Male.—Primaries pale brown, crossed from the costal to the inner margin by zigzag black lines; a rather large brownish-black spot near the anal angle and one above on the outer margin; the fringe alternately black and pale brown: secondaries cream-colour, with the fringe alternately black and cream-colour. Antennæ black; the head, thorax, and abdomen brown.—*Female* very similar to the male, but with the secondaries pale brown.

Expanse, ♂ $1\frac{1}{4}$, ♀ $1\frac{1}{2}$ inch.

Hab. East Africa, Dar-es-Salaam (*Mus. Druce*).

Æcura Whitei, sp. n.

Female.—Primaries brown, with a large greyish-white spot near the apex, and the inner margin from the base to the anal angle broadly bordered with greyish white, dentated on the inner side: secondaries dull brown; the fringes of both wings brown. The head, antennæ, and collar brown; the thorax and tegulæ greyish white; the abdomen and legs brown.

Expanse $1\frac{1}{2}$ inch.

Hab. West Africa, Old Calabar (*White, Mus. Druce*).

This species is allied to *O. Goodii*, Holland.

Æcura pytna, sp. n.

Male.—Primaries brownish fawn-colour, darker along the costal margin; a small black streak close to the base; a large greyish-white marking near the apex, below which are two or three brownish-black markings; the fringe alternately light and dark brown: secondaries pale greyish brown, with two darker brown spots on the outer margin; the fringe pale greyish white. Antennæ black; the head, thorax, and abdomen dark greyish brown.

Expanse $1\frac{1}{2}$ inch.

Hab. West Africa, Gambia (*Mus. Druce*).

Fam. Notodontidæ.

Notodonta (?) *phronima*, sp. n.

Male.—Primaries semihyaline greyish white, darkest at the base and along the costal margin; a faint black streak at the end of the cell; a wide, red, curved, elongated spot about the middle of the inner margin: secondaries hyaline white, shaded with pinkish fawn-colour along the inner margin. Underside of both wings white; antennæ pale brown; the head and thorax pale brown, thickly clothed with reddish hairs; abdomen yellowish brown; legs white.

Expanse $2\frac{1}{4}$ inches.

Hab. South Brazil (*Mus. Druce*).

Very distinct from any other species known to me, and will probably require to be placed in a new genus.

Fam. Arctiidæ.

Catarctia unicolor, sp. n.

Female.—Primaries and secondaries uniformly chestnut-reddish brown. The head, antennæ, and thorax of the same colour; abdomen yellowish brown, with a double row of black spots on the upperside.

Expanse $2\frac{1}{4}$ inches.

Hab. West Africa, Mongo-ma-Lobah (*Mus. Druce*).

Spilarctia puella, sp. n.

Male.—Primaries white, the veins all black: secondaries white, shaded with yellow along the inner margin; the fringe of both wings white. Underside as above, but with the costal margins of both wings yellow. The head and thorax

white; the collar yellow; antennæ black; abdomen deep chrome-yellow, with a row of black spots down the middle.

Expanse $1\frac{3}{4}$ inch.

Hab. South-east Africa, Pondoland (*Mus. Druce*).

Spilarctia vittata, sp. n.

Male.—Primaries very pale brownish white, with three square-shaped brown spots along the costal margin—the first near the base, the second about the end of the cell, the third near the apex; the inner and outer margins thickly irrorated with small brown scales. The underside with the brown costal marks as above; the wing shaded with pink from the base to beyond the middle. Secondaries white, with the inner margin shaded with pink; a small black spot at the end of the cell. The head, thorax, and base of the abdomen brownish white, the abdomen pink above, brownish white on the underside; the antennæ and legs pink.

Expanse $1\frac{3}{4}$ inch.

Hab. West Africa, Mongo-ma-Lobah (*Mus. Druce*).

Spilarctia radiosa, sp. n.

Female.—Primaries cream-colour, crossed by two brown >-shaped lines—the first near the base, the second beyond the middle, extending from the costal margin to the end of the cell, then to the outer margin; several dark brown spots near the apex and a marginal row of brown spots extending from the apex to the anal angle: secondaries nearly white, with a small black spot at the end of the cell; two brown spots close to the anal angle and one near the apex, and a marginal row of minute brown dots at the apex, extending partly round the outer margin. Underside of both wings very similar to the upperside. Antennæ black; head very pale yellow; thorax cream-colour, spotted with black; the abdomen yellow, with a row of black spots on each side, the underside of the abdomen brownish white.

Expanse 3 inches.

Hab. West Africa, Calabar (*Mus. Druce*).

Spilarctia rava, sp. n.

Female.—Primaries pale brownish fawn-colour, thickly irrorated with darker brown scales, which form two very indistinct bands crossing the wing from the costal to the inner margin: secondaries white, with a large black spot at the end of the cell, two at the anal angle, and one close to the apex.

The head and thorax pale brownish fawn-colour, spotted with black; the abdomen yellow, with three bands of black spots, one down the middle and one on each side; the underside of the abdomen and legs brown; antennæ black.

Expanse $2\frac{1}{4}$ inches.

Hab. West Africa, Gambia (*Mus. Druce*).

Idalus (?) *evippus*, sp. n.

Male and female.—Primaries pale pea-green, the costal and outer margins edged with yellow, the fringe yellow: secondaries semihyaline, considerably paler than the primaries, the fringe very pale yellow. The head, thorax, and abdomen pea-green; antennæ black; the front of the head, underside of the thorax, and the legs yellow.

Expanse, ♂ ♀, $1\frac{1}{4}$ inch.

Hab. Bolivia (*Mus. Druce*).

Idalus *leos*, sp. n.

Primaries pale citron-yellow, crossed near the base by a faint zigzag reddish-brown line and beyond the middle by a straight reddish-brown line that extends from the apex to the middle of the inner margin; a round brown spot at the end of the cell; the fringe yellow: secondaries cream-colour; the head, antennæ, thorax, and abdomen yellow; the anal tuft pale brown.

Expanse $1\frac{3}{10}$ inch.

Hab. Ecuador, Sarayacu (*Mus. Druce*).

Euchaetes (?) *lucida*, sp. n.

Male.—Primaries yellow, darkest at the base and along the costal margin; a small black spot at the end of the cell; the fringe yellow: secondaries cream-colour. The head, thorax, and abdomen chrome-yellow, the abdomen spotted with black down the middle; antennæ black.—*Female* the same as the male, but darker in colour.

Expanse $1\frac{1}{4}$ inch.

Hab. East Africa, Dar-es-Salaam (*Mus. Druce*).

. Fam. *Lithosiidæ*.

Darantasia *Goldiei*, sp. n.

Male.—Primaries glossy purple-black, the base, apex, and a band near the apex chrome-yellow: secondaries chrome-yellow, broadly bordered with black. The head, antennæ,

thorax, and legs chrome-yellow; abdomen purple-black; the anus chrome-yellow.

Expanse 1 inch.

Hab. New Guinea, Port Moresby (*Mus. Druce*).

Darantasia cærulescens, sp. n.

Male.—Primaries bright glossy blue-black, the base and a rather wide band beyond the cell chrome-yellow; the fringe black: secondaries black, with a large central, round, chrome-yellow spot. The head, thorax, and anal segments of the abdomen chrome-yellow; the antennæ black, tipped with yellow; the abdomen black.

Expanse $1\frac{1}{4}$ inch.

Hab. Ferguson Island (*Mus. Druce*).

Fam. *Melameridæ*.

Mennis striata, sp. n.

Male.—Primaries chrome-yellow, the apex broadly black, streaked with yellow; a band of four black spots cross the wing about the middle from the costal to the inner margin: secondaries chrome-yellow, the apex and outer margin spotted with black. The head and antennæ black, the front of the head and collar white; thorax chrome-yellow; abdomen black, banded with white; legs black.

Expanse 1 inch.

Hab. Ecuador, Angamarca (*Mus. Druce*).

Mennis amica, sp. n.

Male.—Primaries semihyaline yellow, the apex black, enclosing a rather large oval-shaped white spot, below which are two white streaks: secondaries semihyaline yellow, narrowly edged with black from the apex to the anal angle. The head, antennæ, and palpi black; the thorax, abdomen, and legs yellow.

Expanse 1 inch.

Hab. Ecuador, Sarayacu (*Mus. Druce*).

Ephialtias bætifica, sp. n.

Primaries black, shot with rich dark blue to beyond the middle; a narrow pale yellow band crosses the wing beyond the cell from the costal margin to the anal angle; the fringe black: secondaries dark glossy blue, the apex and outer margin edged with black. The head, antennæ, and thorax

black; abdomen and legs glossy blue; the underside of the head and front of the thorax yellow.

Expanse 2 inches.

Hab. Ecuador, Angamarca (*Mus. Druce*).

Devara pallida, sp. n.

Male.—Primaries blackish brown, the veins all black; an elongated spot at the end of the cell and a wide streak below the cell from the base almost to the anal angle orange-yellow: secondaries orange-yellow, broadly bordered with black, the veins black. The head, antennæ, thorax, abdomen, and legs black.

Expanse $1\frac{1}{2}$ inch.

Hab. Bolivia (*Mus. Druce*).

Fam. *Dioptidæ*.

Neolaurona citrina, sp. n.

Primaries very similar to *N. ovia*, but with all the markings near the base and the first band crossing the wing orange-yellow instead of white: secondaries orange-yellow, broadly bordered with black. The head, antennæ, thorax, and abdomen black; underside of the abdomen greyish white.

Expanse 2 inches.

Hab. Upper Amazons (*Mus. Druce*).

Stenele catax, sp. n.

Male.—Primaries pale semihyaline fawn-colour; the costal margin, apex, and outer margin broadly black; a marginal row of fine rather large white spots extends from the apex to the anal angle: secondaries pale semihyaline fawn-colour, with the costal margin, apex, and outer margin black, and a row of white spots extends from the apex partly round the outer margin. The head, antennæ, thorax, and abdomen black; tegulæ black, with a white dot at the base; the underside of the abdomen fawn-colour; the legs black.

Expanse $2\frac{1}{2}$ inches.

Hab. Colombia (*Mus. Druce*).

Fam. *Limacodidæ*.

Miresa sobrina, sp. n.

Male.—Primaries dark brown, crossed from the costal to the inner margin by two darker brown lines—the first zigzag,

close to the base, the second beyond the middle: secondaries pale brown, palest at the base. The head, antennæ, and thorax dark brown; abdomen reddish brown, the anal tuft dark brown.

Expanse $1\frac{1}{2}$ inch.

Hab. New Caledonia (*Mus. Druce*).

Miresa alma, sp. n.

Male.—Primaries and secondaries uniformly creamy white, shaded with yellowish brown along the inner margins of the secondaries. The head, antennæ, and thorax creamy white; abdomen black, banded with yellow; the legs dark brown.

Expanse $1\frac{3}{4}$ inch.

Hab. New Caledonia (*Mus. Druce*).

XXXIII.—*Note on the Specific Name of the Saccammina of the Carboniferous Limestone.* By FREDERICK CHAPMAN, A.L.S., F.R.M.S.

IN the course of some investigations amongst Microzoa from the Carboniferous Limestone of Ireland I have met with the well-known Carboniferous foraminifer *Saccammina* in some abundance.

So far as I was aware *S. Carteri*, Brady, had not been definitely recorded (under that name) from the Irish limestones, excepting a general remark which Dr. H. B. Brady made in his report on the Foraminifera of the 'Challenger' Expedition in 1884*.

In 1849†, however, McCoy had recorded certain foraminifera from the Carboniferous Limestone of Ireland, to which he gave the name of "*Nodosaria fusulinaformis*." These specimens were described, but not figured, and up to the present appear to have been regarded as too ill-defined for the name to be retained; and, moreover, the name *Saccammina Carteri* had been fully established before McCoy's species had been, as it were, rediscovered.

The evidence for *Nodosaria fusuliniformis* of McCoy has been therefore carefully examined, and by the present note I think it will be seen to be identical with Brady's *Saccammina Carteri*.

* Zoology, vol. ix. p. 253.

† "On some new Genera and Species of Palæozoic Corals and Foraminifera," Ann. & Mag. Nat. Hist. ser. 2, vol. iii. pp. 131, 132.

The first record of these Irish specimens was made, as before stated, by McCoy in 1849, when he gave the following description of the fossil * :—

“ *Nodosaria fusulinaformis*.

“ *Sp. Char.*—Shell of two or more inflated, pyriform, easily separable lodges, the first one having a small mucronate point at its posterior end, and contracted to a very slender, short neck at the anterior end, which joins the pyriform second cell, which is also contracted to a similar minute neck in front; surface smooth. Length of individual cells averaging 1 line, width $\frac{2}{3}$ of a line.”

McCoy also mentioned the very characteristic feature, well-known in the Carboniferous *Saccamina*, of the segments uniting in a moniliform series. He states that “The lodges or cells are almost always found separated (from the minuteness of the connecting neck), which gives them the striking resemblance to *Fusulina* above alluded to; I have *heard*, however, of several of them having been united in a line by their little necks, and I have myself seen two thus united, and the posterior cell not being a terminal one.”

The organism was found “in great numbers on the weathered surfaces of the Carboniferous Limestone in the parish of Shivey, Tyrone, in the North of Ireland.”

Although no figure was given with the description, it appears to me to give the chief characters of the fossil as regards the material available to McCoy, and in point of fact the description could not be applied to any other foraminifer occurring in the Carboniferous Limestone. The chief stumbling-block to the acceptance of McCoy’s name seems to be the comparison which he made between this form and d’Orbigny’s *Nodosaria rudis* and *N. rugosa*; but it is very evident to me that McCoy referred to the form of the segments, and not to the texture of the surface, which, indeed, in his description he distinctly stated is smooth.

This occurrence and description of the fossil were given later in the same words by McCoy in another publication in 1854 †.

In 1869 ‡ H. B. Brady recorded the discovery of similar organisms amongst Charles Moore’s foraminifera from “mineral veins,” and gave to them a generic name—*Carteria*. This

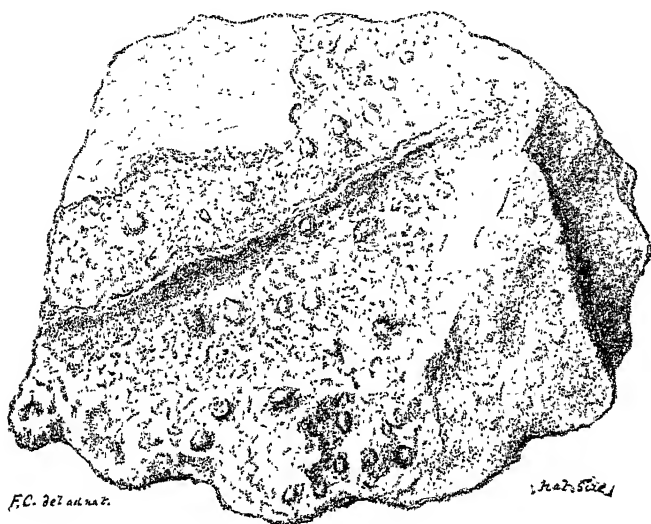
* *Op. cit.* p. 131.

† *Contrib. Brit. Palæont.* pp. 100, 101.

‡ *Rep. Brit. Assoc., Exeter Meeting*, p. 372.

name was, however, in 1871* put aside for Sars's genus *Saccammina*, to which Brady saw they belonged. At various intervals since this time *S. Carteri* has been recorded from various horizons in the Carboniferous Limestones of England, Scotland, and Belgium. For the synonymy up to 1876 one may refer to Brady's monograph on the Carboniferous and Permian Foraminifera †.

The original specimens were stated by McCoy to be deposited in the collections of the University of Cambridge and Royal Dublin Society. To make the identification perfectly sure I have examined the specimen from the latter collection, which has the original label attached; and for this privilege



Saccammina fusuliniformis, McCoy, sp. On weathered surface of Carboniferous Limestone, Shivey, Co. Tyrone, Ireland. (From the original specimen in the Woodwardian Museum, Cambridge.)

I am indebted to the Director and Mr. H. Woods, the Curator of the Woodwardian Museum. The foraminifera on this original specimen have been weathered out of the limestone block and are quite comparable with the typical Carboniferous *Saccamminæ*. Since no figure has hitherto been given of the original specimen, a portion of the limestone surface is now shown.

* Ann. & Mag. Nat. Hist. ser. 4, vol. vii. p. 177, pl. xii.

† Palæont. Soc. vol. xxx. 1876, p. 57.

For some specimens from Ireland containing *Saccamina fusuliniformis*, McCoy, sp., I am indebted to Miss M. K. Andrews, of Belfast, who has with great kindness furnished me with numerous samples of limestones and shales from various parts of Ireland, in order to further the study of their Microzoa. The Irish *Saccaminæ* thus lately obtained are from the Lower Limestone shales of Castle Espie, Co. Down.

XXXIV.—*On a Collection of Heterocera made in the Transvaal.* By W. L. DISTANT.

Noctuidæ.

IN dealing with this family of Transvaal moths a special fact is at once recognized—apparently also applicable to the Pyralidæ—which is, that the South-African Noctuids cannot be studied alone. Entomologists who may have had good reasons to conclude that in other groups of insects there is little community between the Ethiopian and Oriental faunas will find that the rule does not apply to these moths. Not only genera, but very many species, are common to the two regions, while others are of a more or less world-wide distribution and have an extended range in such unlikely areas as North and South America, Australia, &c. It will thus be seen that caution is necessary in describing South-African Noctuidæ, for many of these inhabitants of grassy plains have as wide a distribution as their natural surroundings. They are truly wanderers on the face of the earth, and many of these moderately small and obscure moths, which neither by habit nor coloration invite notice, must possess an antiquity commensurate to the requirements for their vast migration.

Of the 108 species here enumerated or described, the following 9 species have a

More or less universal distribution.

Heliothis armigera, Hübn.
Agrotis plecta, Linn.
Spodoptera mauritia, Bois.
Prodenia littoralis, Bois.
Caradrina exigua, Hübn.

Hyblæa pueræ, Cram.
Cosmophila erosa, Hübn.
Plusia eriosoma, Doubl.
Calpe capucina, Esp.

Of these 5 at least have been recorded from the American continent or adjacent islands.

No fewer than 29 species are found in, some first described from,

The Oriental Region.

<i>Chariclea marginalis</i> , Walk.	<i>Polydesma umbricola</i> , Boisd.
<i>Agrotis biconica</i> , Koll.	<i>Ophiusa algira</i> , Linn.
— <i>segetis</i> , Schiff.	— <i>melicerte</i> , Dru.
— <i>putris</i> , Linn.	— <i>tirrhaca</i> , Cram.
<i>Euplexia niveiplaga</i> , Walk.	<i>Grammodes geometrica</i> , Fabr.
<i>Caradrina quadripunctata</i> , Fabr.	— <i>stolida</i> , Fabr.
<i>Leucania Loreyi</i> , Dup.	<i>Plusia circumflexa</i> , Linn.
<i>Acrapex leucophlebia</i> , Hamps.	— <i>ni</i> , Hübn.
<i>Tarache tropica</i> , Guen.	— <i>orichalcea</i> , Fabr.
— <i>upsilon</i> , Walk.	— <i>limbirena</i> , Guen.
<i>Xanthoptera opella</i> , Swinh.	<i>Plusiodonta cœlonota</i> , Koll.
<i>Acontia Grællsii</i> , Feisth.	<i>Hydrillodes lentalis</i> , Guen.
— <i>malvæ</i> , Esp.	<i>Hypena abyssinialis</i> , Guen.
<i>Eublemma divisa</i> , Moore.	— <i>masurialis</i> , Guen.
<i>Cosmophila mesogona</i> , Walk.	

Of these at least 12 are also found in Europe and several in Australia.

I have followed, both in genera and species, the synthetic arrangement of Sir George Hampson, to whom I am indebted for much assistance in the preparation of this paper. Dr. Aurivillius has also kindly compared most of the species I have here described as new with Wallengren's types of South-African moths in the Stockholm Museum. Those he described from the Transvaal, as I have already stated (*ante*, p. 47, note), are somewhat unavailable, there being no entomologist in charge at the museum in which they are deposited.

Subfam. *TRIFINÆ*.

<i>Heliothis armigera</i> , Hübn.	Pretoria, Johannesburg.
— <i>scutigeræ</i> , Guen.	Johannesburg.
<i>Chariclea marginalis</i> , Walk.	Pretoria.
<i>Agrotis biconica</i> , Koll.	Pretoria, Johannesburg.
— <i>segetis</i> , Schiff.	Barberton (<i>Dr. P. Rendall</i>), Pretoria, Johannesburg.
— <i>trux</i> , Hübn., var.	Pretoria.
— <i>cinctithorax</i> , Walk.	Pretoria, Johannesburg.
— <i>intendens</i> , Walk.	Pretoria.
— <i>plecta</i> , Linn.	Pretoria, Johannesburg.
— <i>effracta</i> , sp. n.	Pretoria.
— <i>transjecta</i> , sp. n.	Pretoria.
— <i>putris</i> , Linn.	Johannesburg.
— <i>mucosa</i> , Hübn.	Barberton (<i>Dr. P. Rendall</i>).
<i>Hadena breviuscula</i> , Walk. (?)	Pretoria.
— <i>renisigna</i> , Walk.	Pretoria.
— <i>Bulgeri</i> , F. & R.	Pretoria, Johannesburg.
<i>Euplexia niveiplaga</i> , Walk.	Pretoria.
<i>Cuculia extricata</i> , Walk.	Pretoria.

- Spodoptera mauritia*, Boisd. Pretoria.
Tozocampa plumbea, sp. n. Pretoria.
Hemipachycera Yerburii, Butl. Johannesburg.
Prodenia littoralis, Boisd. Barberton (*Dr. P. Rendall*), Pretoria.
Caradrina quadripunctata, Fabr. Pretoria.
 — *exigua*, Hubn. Pretoria.
Leucania plana, Walk. Johannesburg.
 — *Loreyi*, Dup. Waterberg (*Wilde*).
 — *amens*, Guen. Pretoria.
 — *torrentium*, Guen. Pretoria.
 — *apparata*, Wallengr. Pretoria, Johannesburg.
 — *substituta*, Wallengr. Pretoria, Johannesburg.
Acrapex leucophlebia, Hamps. Pretoria.

Agrotis effracta, sp. n.

Head, thorax, and antennæ dark reddish brown; abdomen above and body beneath paler.

Anterior wings dark reddish brown, much paler at apical angle, below which the outer area is generally much darker; orbicular and reniform spots, which are well defined and have their margins blackish, connected by a narrow black fascia; this fascia also extends from the reniform spot to outer margin, where it is preceded above by a short black streak. Posterior wings pale ochreous white. Anterior wings beneath brownish ochraceous, darkest to a little beyond cell; posterior wings beneath with faint indications of a transverse discal series of small spots.

Exp. wings 27–31 millim.

Hab. Transvaal, Pretoria (*Distant*).

Specimens are in the British Museum from Malvern and Durban in Natal.

Agrotis transjecta, sp. n.

Head and pronotum ochraceous, with black markings; mesonotum very dark fuscous; abdomen above and body beneath pale ochraceous; legs more or less shaded with fuscous.

Anterior wings shining ochraceous, with purplish and fuscous reflections; costal margin narrowly fuscous, with a larger spot near apex; a large dark fuscous cellular streak enclosing both orbicular and reniform spots, which are pupillate and margined with pale ochraceous; beneath cell a slender dark fuscous basal streak; beyond cell the wing is crossed by a curved series of small fuscous spots, and a similar series of spots on outer margin; between these two series of spots is a small fuscous patch beyond cell and a similar one near outer angle. Posterior wings pale creamy white. An-

terior wings beneath paler than above; posterior wings beneath with a terminal fuscous cellular spot, costal speckles and apical suffusion, and a faint submarginal series of spots.

Exp. wings 26-27 millim.

Hab. Transvaal, Pretoria (*Distant*).

A specimen from Madagascar is in the British Museum.

Toxocampa plumbea, sp. n.

Head and anterior margin of thorax black, remainder of thorax, abdomen, and body beneath greyish white, speckled with black.

Anterior wings greyish brown, with a roseate reflection; reniform spot slightly prominent, outer margin broadly dark fuscous, costal and inner margins very narrowly and outer marginal fringe silvery grey; some small obscure dark costal marginal spots. Posterior wings plumbeous, the fringe silvery grey and with similarly coloured hairs on anal area. Wings beneath pale plumbeous, the discal area of anterior wings and the inner area of posterior wings silvery grey.

Exp. wings 32-35 millim.

Hab. Transvaal, Pretoria (*Distant*).

Specimens from Annshaw, Eastern Cape Colony, are in the British Museum.

Subfam. ACONTINÆ.

Dipthera verbenata, sp. n. Barberton (*Dr. P. Rendall*).

— *autumnalis*, sp. n. Barberton (*Harrison*), Pretoria.

Megalodes pienaari, sp. n. Pienaars River.

Tarache caffraria, Cram. Pretoria, Johannesburg.

— *dispar*, Walk. Pretoria, Johannesburg.

— *upsilon*, Walk. Pretoria.

— *margaritata*, Dru. Johannesburg.

— *natahs*, Hübn. Pretoria, Warm Baths, Waterberg.

— *admota*, F. & R. Johannesburg.

— *tropica*, Guen. Pienaars River.

— *guttifera*, F. & R. Pienaars River.

— *torrefacta*, sp. n. Pretoria.

— *æthiops*, sp. n. Pretoria.

Pergea dolorosa, Walk. Pretoria.

Microphysa hypotania, Wallengr. Barberton (*Dr. P. Rendall*), Pretoria.

Xanthoptera opella, Swinh. Pretoria.

Acontia Grællsü, Feisth. Barberton (*Dr. P. Rendall*).

— *malvæ*, Esper. Pretoria.

Metachrostis dubitans, Walk. Barberton (*Dr. P. Rendall*), Pretoria, Johannesburg.

— *densa*, Walk. Pretoria, Johannesburg.

— *varia*, Walk. Pretoria.

— *vultuosa*, sp. n. Barberton (*Dr. P. Rendall*), Pretoria.

— *accincta*, sp. n. Pretoria.

Eublemma divisa, Moore. Pretoria.

— *apicata*, sp. n. Pretoria.

— *pretoriæ*, sp. n. Pretoria.

Diptera verbenata, sp. n.

Head and thorax very pale olive-green, mottled with grey and fuscous; antennæ brownish ochraceous; abdomen and body beneath pale greyish ochraceous; eyes black; anterior and intermediate tarsi strongly, posterior tarsi faintly, broadly annulated with fuscous.

Anterior wings very pale olivaceous green, speckled with greyish, costal margin alternately greyish and black; orbicular spot obscure, broadly black at edges, reniform spot faint and pale; three transverse and much waved black fasciæ, the second outwardly, the third inwardly margined with greyish white; first fascia close to base, second crossing cell, third between cell and outer margin, which is narrowly black, but prominently toothed between the veins. Posterior wings pale ochreous white, thickly speckled with fuscous on outer half, and with a narrow fuscous marginal border. Wings beneath pale ochreous white, thickly speckled with fuscous on costal and outer areas.

Exp. wings 32–36 millim.

Hab. Transvaal, Barberton (*Dr. Percy Rendall*).

Two specimens. In the second the black transverse fasciæ to the anterior wings are broader and more suffused.

Diptera autumnalis, sp. n.

Head and thorax pale olivaceous, speckled with grey and black; abdomen and body beneath pale greyish ochraceous; antennæ fuscous; eyes black.

Anterior wings very pale olivaceous, costal margin alternately greyish and black; crossed by five much waved narrow black fasciæ, between which the olivaceous coloration is darker and more speckled with black, first fascia a short distance from base, second and third near end of cell, fourth and fifth between end of cell and outer margin; fringe with furcate black fasciæ; at apex there is a distinct black suffusion. Posterior wings pale creamy white, the outer margin narrowly fuscous. Wings beneath creamy white; anterior wings much shaded with fuscous; posterior wings similarly shaded on costal and apical margins.

Exp. wings 30–33 millim.

Hab. Transvaal, Barberton (*Harrison*), Pretoria (*Distant*).

Two specimens, one from each locality. In the Pretorian

example the whole area between the second and fifth fasciæ of the anterior wings is suffused with black, which colour again connects the first and second fasciæ on the inner margin.

Megalodes pienaari, sp. n.

Head and thorax creamy white, with a few fuscous and black markings; apex of head, antennæ, abdomen, and body beneath brownish ochraceous; tibiæ annulated with fuscous; eyes black.

Anterior wings creamy white, cellular area extending to costa nearly altogether suffused with fuscous brown; a narrow transverse black fascia near base and another much waved beyond cell, the outer margin also narrowly black; the outermost fascia is broadly black and directed inwardly beneath cell, where it is outwardly margined by fuscous brown, and a plumbeous suffusion; at apex beyond the fascia is a brownish ochraceous costal spot, followed by a plumbeous one. Posterior wings creamy white, with a faint ochraceous tinge; a somewhat obscure brownish discal spot and transverse fascia; the extreme margin also fuscous brown. Wings beneath greyish white; anterior wings nearly wholly suffused with fuscous, excepting inner area beneath cell and apex; posterior wings as above.

Exp. wings 23–25 millim.

Hab. Transvaal, Pienaars River (*Distant*), Pretoria (*Distant*).

Tarache torrefacta, sp. n.

Body, legs, and antennæ ochraceous; body paler beneath; eyes black.

Anterior wings ochraceous, suffused with brownish ochraceous, especially at basal, inner, and apical areas; at middle of inner area and at apex is a dark purplish suffusion; beneath apex and gradually widening to outer angle the outer margin is bright warm ochraceous. Posterior wings pale ochraceous, somewhat thickly speckled with brownish ochraceous, darkest at apex and outer margin. Wings beneath generally as above, but anterior wings without the two purplish suffusions and posterior wings with a dark discal spot.

Exp. wings 22–25 millim.

Hab. Transvaal, Pretoria (*Distant*).

Tarache æthiops, sp. n.

Head and antennæ brownish ochraceous, eyes black;

thorax and abdomen above pale fuscous; body beneath and legs pale fuscous; the tarsi ochraceous.

Anterior wings dark fuscous, with a broad transverse ochreous-white fascia near base, a similarly coloured costal spot beyond end of cell, and the outer area suffused with the same tint, especially at apex and outer angle; a small fuscous mark is in the costal pale spot, and there are a series of small dark spots on extreme outer margin. Posterior wings plumbeous, the fringe ochraceous. Wings plumbeous, the pale markings to anterior wings scarcely visible beneath.

Exp. wings 18 millim.

Hab. Transvaal, Pretoria (*Distant*).

Metachrostis vultuosa, sp. n.

Body above chocolate-brown, margins of the abdominal segments paler; body beneath and legs pale ochraceous; abdomen brownish ochraceous.

Anterior wings chocolate-brown, costal margin spotted with golden yellow, which is most prominent at apex, and is there the commencement of two very obscure submarginal yellowish waved fasciæ; reniform spot large and margined with dull ochraceous; beyond this spot the wing is crossed by a strongly waved and bent transverse fascia; near base are some other transverse linear fasciæ (scarcely discernible in some specimens) and an oblique series of obscure yellow spots extending from costa across cell. Posterior wings paler and brighter chocolate-brown, with a marginal series of small golden-yellow spots, of which the largest are at anal angle and apex. Anterior wings beneath chocolate-brown, the cellular area, a short transverse bar beyond it (in some specimens continued as a fascia to inner margin), a submarginal series of spots, and about basal half of inner marginal area golden yellow. Posterior wings beneath golden yellow, crossed by a discal and a submarginal fascia, chocolate-brown; the posterior margin of the same colour and connected with the submarginal fascia, so as to enclose a series of small yellow spots.

Exp. wings 25 millim.

Hab. Transvaal, Pretoria (*Distant*), Barberton (*Dr. P. Rendall*).

Specimens from Estcourt, Natal, are in the British Museum.

Metachrostis accincta, sp. n.

Body and legs pale brownish ochraceous.

Anterior wings pale brownish ochraceous; crossing the wing and almost enclosing the reniform spot is a broad

chocolate-brown fascia, closely followed by a narrow pale and much bent fascia, which joins the broad fascia on inner margin and is chocolate on costal margin; outer marginal area reddish ochraceous; a series of minute dark spots on outer margin, preceded by a pale waved linear fascia; fringe very pale brown. Posterior wings pale golden yellow, the costal area broadly pale chocolate-brown. Wings beneath much paler than above.

Exp. wings 18–20 millim.

Hab. Transvaal, Pretoria (*Distant*).

Eublemma apicata, sp. n.

Head, thorax, and base of abdomen pale ochraceous brown, lateral lines, meeting in front, to thorax and apical two thirds of abdomen purplish brown; body beneath and legs pale ochraceous brown.

Anterior wings pale reddish brown; an obscure darker fascia (broadest at costal area) crossing wing beyond cell; apex and a spot margining fascia near inner angle creamy white; a submarginal series of minute dark spots. Posterior wings dark plumbeous, the fringe creamy white. Wings beneath brownish ochraceous, both with broad marginal dark fasciæ, apex of anterior wings narrowly white.

Exp. wings 22–23 millim.

Hab. Transvaal, Pretoria (*Distant*).

Eublemma pretoriæ, sp. n.

Body and legs pale dull ochraceous.

Anterior wings dull ochraceous; a short transverse brown fascia, strongly bent at reniform spot and more or less bifid at costal area; a large dark brown apical spot more or less continued as a submarginal fascia, but not reaching inner angle; two longitudinal dark brown lines, one traversing cell, the other more oblique beneath cell, both nearly reaching outer margin. Posterior wings very pale golden yellow, extreme outer margin very narrowly darker. Wings beneath with the markings more obscure.

Exp. wings 20–23 millim.

Hab. Transvaal, Pretoria (*Distant*).

Specimens are in the British Museum from Estcourt, Natal.

Subfam. *SARROTHRIPINÆ*.

Hyblæa puera, Cram. Pretoria.

Subfam. *EUTELINÆ*.

Euteha Bowkeri, F. & R. Barberton (*Harrison*).

Subfam. *STICTOPTERINÆ*.

Audea ochreipennis, Butl. Pretoria.

Subfam. *GONOPTERINÆ*.

Cosmophila mesogona, Walk. Pretoria, Johannesburg.

— *involuta*, Walk. Pretoria.

— *erosa*, Hübn. Pretoria.

Subfam. *QUADRIFINÆ*.

Matopo typica, gen. et sp. n. Pretoria (*T. Donovan*).

Hypocala subsatura, Guen. Pretoria.

Bolina revulsa, Wallengr. Pretoria, Johannesburg.

Cylogramma latona, Cram. Barberton (*Dr. P. Rendall*), Pretoria, Johannesburg.

Nyctipao macrops, Linn. Barberton (*Harrison*).

Polydesma umbricola, Boisd. Johannesburg, Zoutpansberg.

— *semiusta*, sp. n. Pretoria.

— *balnearia*, sp. n. Warm Baths, Waterberg.

— *dissimilis*, sp. n. Waterberg (*Wilde*).

Sphingomorpha monterionis, Butl. Barberton (*Dr. P. Rendall*), Pretoria, Johannesburg.

Ophiusa croceipennis, Walk. Barberton (*Dr. P. Rendall*), Zoutpansberg.

— *pretorice*, Dist. Pretoria.

— *melicerte*, Dru. Waterberg (*Wilde*), Johannesburg.

— *algira*, Linn. Barberton (*Dr. P. Rendall*), Pretoria.

— *salita*, sp. n. Pretoria, Johannesburg.

— *tirrhaca*, Cram. Waterberg (*Wilde*), Pretoria.

— *xylina*, sp. n. Pretoria.

— *echo*, Walk. Lydenburg District (*Zutrzenka*).

Delgamma zonaria, sp. n. Barberton (*Dr. P. Rendall*), Pretoria.

Baniana recussa, sp. n. Pretoria.

Plecoptera immitis, Walk. (?) Warm Baths, Waterberg.

Remigia mutuaria, Walk. Warm Baths, Waterberg.

Cercocala vermiculosa, H.-S. Pretoria.

Grammodes geometrica, Fabr. Zoutpansberg (*Kæssner*), Pretoria, Johannesburg.

— *stolida*, Fabr. Zoutpansberg (*Kæssner*), Pretoria, Johannesburg.

Trigonodes obstans, Walk. Barberton (*Harrison*), Zoutpansberg (*Kæssner*).

Thermesia anneza, sp. n. Johannesburg (*Cregoe*).

Spirama capensis, H.-S. Barberton (*Dr. P. Rendall*), Lydenburg District (*Zutrzenka*).

Calliodes rivuligera, Butl. Lydenburg District (*Zutrzenka*).

Calpe apicalis, Walk. Pretoria.

— *capucina*, Esp. Waterberg (*Wilde*), Pretoria.

Plusia eriosoma, Doubl. Pretoria.

— *circumflexa*, Linn. Pretoria.

Plusia ni, Hübn. Pretoria.

— *orichalcea*, Fabr. Pretoria, Johannesburg.

— *limbirena*, Guen. Pretoria.

— *exquisita*, F. & R. Pretoria, Johannesburg.

Plusiodonta caelonota, Koll. Barberton (*Harrison*).

Rhanidophora phædonia, Stoll. Barberton (*Dr. P. Rendall*), Rustenburg.

MATOPO, gen. nov.

Palpi extended a little in front of head, the second joint clothed with long hairs; antennæ pectinate; frons prominently produced; thorax hairy; abdomen hairy on segmental margins; tibiæ moderately hairy.

Allied to the Oriental genus *Trisula*, Moore, from which it differs by the pectinate antennæ and prominent frons.

Matopo typica, sp. n.

Body and wings both above and beneath very pale ochraceous, dusted with silvery white. Anterior wings above with the following chocolate-brown markings:—a small patch beyond and connected with reniform spot, below which extends an oblique series of irregular suffusions situated between the veins, and terminating on inner margin near base in two short streaks; a marginal series of streaks between the veins, which are small and macular near apex and longer towards outer angle.

Exp. wings 37 millim.

Hab. Transvaal, Pretoria (*Donovan*).

Polydesma semiusta, sp. n.

Body and legs pale brownish ochraceous; legs speckled with brownish.

Wings pale ochraceous, thickly speckled with reddish brown; both wings crossed by a discal, much waved, narrow, reddish-brown fascia, commencing on costal margin of anterior wings about midway between end of cell and outer margin, bent inwardly towards end of cell, and then extending more directly across both wings, terminating on anal margin of posterior wings; a similar less waved fascia crossing anterior wings near base through about centre of cell; the outer marginal area of both wings rather more thickly speckled with reddish brown. Wings beneath much paler than above, the fasciæ almost obsolete.

Exp. wings 45 millim.

Hab. Transvaal, Pretoria (*Donovan*).

Polydesma balnearia, sp. n.

Head and thorax greyish, with black shadings (*thorax rubbed in specimen described*); abdomen above pale brownish ochraceous; body beneath and legs greyish white, legs more or less streaked and spotted with fuscous.

Anterior wings pale ochraceous, with narrow reddish-brown striae; base to about one third of cell more or less purplish black, the outer edge clearly defined and containing two short darker striae, commencing at costa and fusing about halfway across wing; beyond cell a much waved transverse purplish fascia, bent inwardly beneath cell, its inner margin purplish black; beyond this fascia the colour is somewhat pale violaceous, with a waved blackish line on outer margin and an apical dark purplish patch with a pale centre. Posterior wings pale greyish ochraceous, with a waved blackish outer marginal line and with the veins more or less minutely speckled. Wings beneath pale ochraceous; apical area of anterior wings and apical margin of posterior wings obscure purplish.

Exp. wings 34 millim.

Hab. Transvaal, Warm Baths, Waterberg (*Distant*).

Polydesma dissimilis, sp. n.

Head and thorax fuscous grey; abdomen and body beneath somewhat silvery grey.

Anterior wings fuscous grey, with silvery reflection, crossed by an obscure and exceedingly waved darker line, commencing at about end of cell and deflected and continued beneath cell to inner margin near base; on outer margin a series of dark rays between the veins. Posterior wings silvery greyish white. Wings beneath obscure silvery greyish white, both wings with a somewhat obsolete narrow brownish submarginal fascia.

Exp. wings 34 millim.

Hab. Transvaal, Waterberg (*Wilde*).

Somewhat diverse from the usual facies of the genus.

Ophiusa salita, sp. n.

Head and thorax reddish ochraceous, the last more or less plumbeous on its posterior area; abdomen and body beneath pale greyish; legs with brownish suffusions.

Anterior wings reddish brown, thickly irrorated with greyish striae; both orbicular and reniform spots prominent, oval, and with pale margins; wing crossed by three narrow

castaneous fasciæ—the first outwardly oblique, crossing base of cell, the second beyond cell, sinuate and bent inwardly, the third between second and outer margin, waved, strongly and outwardly bidentate at about centre; beyond the outer fascia the marginal area is pale violaceous, with a marginal series of small black spots on the veins. Posterior wings very pale plumbeous, the outer marginal areas darker. Wings beneath pale brownish ochraceous, the outer margins darker.

Exp. wings 40 millim.

Hab. Transvaal, Pretoria (*Distant*), Johannesburg (*Cregoe*).

Ophiusa xyliua, sp. n.

Head and thorax pale reddish ochraceous; abdomen and body beneath ochraceous.

Anterior wings very pale brownish or reddish ochraceous, crossed by two narrow castaneous fasciæ—the first outwardly, the second inwardly greyish, the first crossing cell and directed outwardly, the second beyond cell directed inwardly, both almost meeting on inner margin; reniform spot large, prominent, centrally constricted, pale purplish, with darker margin; between the second fascia and outer margin a sinuate series of small dark spots and a subapical purplish-black patch; a waved dark line at outer margin. Posterior wings ochraceous, the outer area broadly pale fuscous, the fringe ochraceous. Wings beneath ochraceous; anterior wings with a broad black outer submarginal fascia; posterior wings with the apical area speckled with fuscous.

Exp. wings 55 millim.

Hab. Transvaal, Pretoria (*Distant*).

Allied to *O. lunaris*, Schiff. Specimens from Natal are in the British Museum.

Delgamma zonaria, sp. n.

Body pale greyish brown; legs and palpi fuscous brown; eyes black.

Anterior wings greyish brown, crossed by two narrow transverse fasciæ—the first slightly curved, crossing at about anterior half of cell, the second slightly oblique between end of cell and outer margin, inwardly broadly margined with purplish brown and outwardly with pale greyish, the outer margin of wing also broadly purplish brown; reniform spot dark and subprominent. Posterior wings generally as anterior, but without the basal fascia. Wings beneath greyish ochraceous; the cellular area of anterior wings and the outer margins of both wings somewhat darker.

Exp. wings 31–36 millim.

Hab. Transvaal, Pretoria (*Distant*), Barberton (*Dr. P. Rendall*).

Baniana recussa, sp. n.

Body pale greyish brown; anterior area of thorax reddish brown; legs speckled with brown.

Anterior wings pale greyish brown, crossed by two narrow fasciæ—the first waved and subobsolete near base, the second commencing on costal margin a little beyond end of cell, slightly sinuate and bent inwardly and upwardly at about centre of wing, and then recurved to inner margin; the area beyond this fascia is dark purplish brown, containing a large pale brown apical spot and sometimes a smaller similar spot on outer margin (*on one wing only in type*); reniform spot dark purplish brown. Posterior wings pale greyish brown, the posterior area darker in hue. Wings beneath pale reddish brown, speckled with greyish or ochraceous; both wings crossed by a discal fascia; a dark spot closing cell in posterior wing.

Exp. wings 26 millim.

Hab. Transvaal, Pretoria (*Distant*).

Allied to *B. semilugens*, Walk.

Thermesia annexa, sp. n.

Head and thorax pale greyish brown; legs pale greyish, speckled with brown.

Wings pale greyish, with darker speckles; anterior wings with the reniform spot purplish brown, beneath which a narrow waved fascia extends to inner margin; a subobsolete narrow transverse fascia near base; a somewhat straight narrow pale fascia a little before outer margin, outwardly margined with purplish brown, which is dentately undulate; extreme outer margin with a series of small dark spots. Posterior wings with a dark submarginal fascia, beyond which the colour is also darker. Wings beneath brownish ochraceous, the outer margins broadly pale fuscous.

Exp. wings 31 millim.

Hab. Transvaal, Johannesburg (*Cregoe*).

Subfam. *DELTOIDINÆ*.

Simplicia inflexalis, Guen. (?). Pretoria.

Hydrillodes lentalis, Guen. Pretoria.

Epizeuxis æthiops, Dist. Pretoria.

Rhynchina cæsa, sp. n. Pretoria, Waterberg.

Hypera abyssinialis, Guen. Pretoria, Johannesburg.

— *masuralis*, Guen. Waterberg (*Wilde*).

Rhynchina cæsa, sp. n.

Head and thorax grey, speckled with brownish; abdomen, body beneath, and legs pale greyish ochraceous.

Anterior wings greyish, speckled with pale brown, especially on costal and inner marginal areas; a waved narrow fascia crosses wing at about two thirds from base, beyond which the colour is much darker—purplish brown and violaceous—excepting near base, where it is grey; the dark hue has the appearance of a broad oblique fascia; a waved dark line on outer margin; reniform spot distinct. Posterior wings pale ochraceous, somewhat darker at posterior margins. Wings beneath pale greyish ochraceous, somewhat pale brownish at apices.

Exp. wings 23–29 millim.

Hab. Transvaal, Pretoria (*Distant*), Waterberg (*Wilde*).

XXXV.—*The Islands and Coral-reefs of the Fiji Group.*

By ALEXANDER AGASSIZ*.

.... On our arrival at Suva we found the 'Yaralla,' a twin-screw steamer of about 500 tons, chartered from the Australasian United Steam Navigation Company, awaiting us. We have now been about six weeks cruising among the islands, and have found the boat admirably suited for our purpose. During the past summer I had shipped to Australia our outfit for dredging, sounding, and for deep-sea towing, as well as all the materials necessary for preserving our collections. This equipment we found safely stored in the 'Yaralla.' I had also brought with me deep-sea tow-nets of the various patterns used by the Prince of Monaco, by Dr. Giesbrecht of the Naples Zoological Station, and by Hensen on the 'National' Expedition, in order to compare their efficiency with the Tanner deep-sea self-closing net in use on the 'Albatross' and which I had adopted on my various expeditions. Unfortunately our time here is so limited and the conditions for towing at great depths among so many intercepting islands are such that the results likely to be obtained seemed to make it unadvisable to devote the time necessary for such a comparison. Although nothing was done to test the different deep-sea self-closing towing-nets, yet we have made at various points along

* From the 'American Journal of Science,' February 1898, pp. 113–123: being extracts from a letter of Alexander Agassiz, dated Suva, Fiji Islands, December 15th, 1897, addressed to E. S. Dana.

our course a number of deep hauls, from 150 fathoms to the surface, with the open net. A large number of hauls were made off Suva which gave us an excellent collection of pelagic forms, the collections of Crustacea and of Acalephs being specially noteworthy. Mr. Mayer will prepare a report on the Acalephs. When practicable we have also made collections on the reef-flats of various islands and atolls*.

I also brought to Suva a complete diamond-drill boring apparatus and a competent man to superintend the work—Mr. W. Evers—recommended to us by the Sullivan Machine Co., of Chicago, from whom the apparatus was obtained †. To provide against contingencies, a comparatively small hand-machine was sent, capable of drilling to a depth of from four to five hundred feet. An oil-motor was also provided to expedite the work with increasing depth.

This machinery had already been shipped when information reached the United States that Professor David, of the University of Sydney, had left for the Atoll of Funafuti in charge of an expedition to take up the unfinished work of boring of the party in charge of Professor Sollas, sent out by the Council of the Royal Society of London. The day before leaving Cambridge for the Pacific, news arrived that Professor David's party had succeeded in reaching a depth of nearly 600 feet, the bottom still being in coral. This information seemed to settle the coral question, and all I hoped to accomplish was merely to confirm the work of Professor David by boring in some other district. Subsequent information received from Professor David leads me to think that the matter is not so simple as was represented by the newspapers. From what we have seen thus far of the Fiji Islands reef I can only conclude that the boring at Funafuti has settled nothing, and that we are still as far as ever from having a general theory of the formation of coral-reefs. In fact, with the present information obtained here I should never have thought of boring in the atolls of this group, for reasons which will be given presently.

The track which we followed was so arranged as to include in our first trip one or two of each type of island and of the different types of atolls, barrier- and fringing-reefs in the

* Dr. Wm. McM. Woolworth and A. G. Mayer accompanied me as assistants. Dr. Woolworth and my son Maximilian have taken a large number of photographs illustrating the physiognomy of the islands and their reefs. A selection from these I shall use in my final report.

† I have to thank the Trustees of the Bache Fund of the National Academy of Sciences at Washington for an appropriation of \$1200 towards defraying a part of the expenses of boring.

group. Starting from Suva, after visiting Mbenga we went to Ovalau, Wakaya, Makongai, Koro, skirted along the western shore of Taviuni, examined the north-eastern coast of the same island, passed through the Matangi passage to Motua Levu and Motua Lailai, skirted along the western extremity of the Nanuku reefs. From there we steamed to Wailangalala, where we landed our boring-apparatus and the crew needed for working the same. We then turned north, passing close to Nuku Mbesanga and Adolphus reef, and entered Ngele Levu Lagoon. We next examined the Ringgold Islands, paying special attention to Thombia, an extinct crater in Budd reef. From there we returned to our former anchorage off Thurston Point in Taviuni, and followed our old track back to Wailangalala, where we found our boring party settled and at work. We then steamed south, examining Williamson reef, the Kimbombo islets, Bell reef, and entered the Vanua Mbalavu Lagoon through the Ngillangillah passage, leaving the lagoon by the Tonga pass. We touched at Mango, Tavutha, Naiau, and Lakemba, passed Aiwa, entered the Oneata Lagoon, visited Thakau Lekaleka, touched at Motha, entered the Komo Lagoon, the Yangasa cluster, and the Ongea Lagoon. We passed Fulanga, close to the entrance, which was too shallow to allow our vessel to enter, but near enough to give an excellent idea of its characteristic structure. We next touched at Kambara, anchored in the crater of Totoya, stopped at Moala; from there we made Solo Lighthouse, examined the North Astrolabe reef, steamed through the Great Astrolabe reef, coming out west of Ono. We next examined a part of the shore of Kandavu, and returned to Suva by way of Vatu Leile. On our second trip we visited Ngau, Nairai, the Horseshoe reef, Mbatiki, and entering the Moturiki Channel south of Ovalau, examined the barrier reef between it and Suva as far as Mbau. After our return to Suva we made a third trip along the southern coast of Viti Levu as far as Naudronga; skirting the reef as closely as was prudent, we were able to follow the changes in the Great Barrier reef of Viti Levu west of Suva as it gradually passes into a fringing reef and disappears off the Singatoka River, to appear again first as a fringing reef and then as a barrier reef extending beyond the Nandi waters to the west of Naudronga. We then paid a second visit to Vatu Leile and returned to Suva, having steamed a little over 1300 miles.

I came to Fiji under the impression that we were to visit a characteristic area of subsidence, for, according to Dana and Darwin, there is no coral-reef region in which it is a simpler

matter to follow the various steps of the subsidence which has taken place here. Dana, in his last discussion of the coral-reef question, states that it is impossible to find a better series of islands than those of the Fiji to illustrate the gradual changes brought about by subsidence, which transform a volcanic island with a fringing reef to one with a barrier, and next to one with a circular reef ring, and finally to one in which the interior island has disappeared and has left only a more or less circular reefing. For these reasons one of the Fiji atolls promised to be an admirable location for boring and settling the question of the thickness of the coral-reef of an atoll. My surprise was great, therefore, to find within a mile from Suva an elevated reef about 50 feet thick and 120 feet above the level of the sea, the base of the reef being underlaid by what is locally called soapstone, probably a kind of stratified volcanic mud. The western extension of this reef can be traced at several points along the north shore of the harbour of Suva, the island of Lambeka and Vua and Dranibotu, which are from 60 to 90 feet in elevation, being part of an elevated reef extending to low-water mark. It was this elevated reef or its extension westward which we traced from the Singatoka River to the Nandi waters. A short distance inland from the mouth of the Singatoka there is a bluff of about 250 feet in height, composed of a coral-reef limestone which is the inner extension of the elevated reef-patches and bluffs visible on the shore of Viti Levu. I am informed by Dr. Corney that the islands of Viwa and Asawailau to the northward of the Nandi waters are also remnants of this elevated reef.

But the traces of extensive elevation are not limited to the larger island of Viti Levu. I found the islands on the rim of the atoll of Ngele Levu to consist entirely of coral-rock elevated to a height of over 60 feet on the larger island. The surface of the island where we crossed it was a mass of hummocks of honeycombed, potted, and eroded coral-masses resembling in every way the elevated reefs with which I had become familiar in the Bahamas, Cuba, and Florida. The northern sides of the island of Ngele Levu are on the very outer edge of the rim of the lagoon, deep water running up to the shore-line. We next found that at Vanua Mbalavu the northern line of islands were parts of an elevated reef forming vertical bluffs of coral-rock which had been raised by the central volcanic mass of the main island to a height of over 500 feet at Ngillangillah, at Avea to 600 feet, at the Savu Islands to 230 feet, and on the main island to a height of nearly 600 feet. On the south of the main island the

elevated coral-bluffs are very much lower, those of Malatta and Susni reaching a height of a little over 400 feet. Going farther west and south we find at Mango the vertical bluffs of an elevated coral-reef of over 600 feet, and underlaid by volcanic rocks which crop out at the sea-level.

At Tavutha the coral-limestone bluffs are probably 800 feet high. At Naiau they are over 500 feet, at Lakemba they reach a height of about 250 feet on the south-west side of the island; the rest of the island is volcanic. On the island of Aiwa the elevated reef is fully 200 feet thick. In the Oneata group the highest point of the elevated reef-bluffs is about 160 feet. South of the volcanic island of Motha and enclosed within the same barrier reef on the island of Karoni the elevated reef is about 120 feet thick. On the three islands of the Yangasa group it attains a thickness varying between 240 and 390 feet, and, finally, on Ongea, the most south-easterly cluster we visited, the elevated reef attains a thickness of nearly 300 feet. At Fulanga the elevated reef attains a thickness of 360 feet, at Kambara it is about 200 feet thick, and at Wangawa it is perhaps over 300 feet: these islands are in part volcanic. Finally, at Vatu Leile, the most westerly island we examined, the elevated reef forming the island is 110 feet thick at its northern extremity.

All this plainly shows that the southern part of Viti Levu and as far south as Vatu Leile, and the whole length of the windward islands of the Fiji group from Ngele Levu on the north to Ongea on the south, have been subject to an elevation of at least 800 feet, as there is abundant proof that a great part of the thickness of the elevated reef has been eroded to reduce it in certain localities to the level of the sea or to leave at others bluffs and islands or islets, the occurrence of which we have traced at so many points.

But the evidence of a very considerable elevation is not limited to that furnished by the remains of the elevated reefs just mentioned. It is natural to assume that the elevation we have just traced was but a part of a more general elevation which perhaps took place in late Tertiary times, and in which the whole group was involved. It is plain that there must have been most extensive denudation and erosion going on throughout the group for a very considerable period of time, geologically speaking. The outlines of the islands deeply furrowed by gorges and valleys, the sharp and serrated ridges separating them, the fantastic outlines of the peaks of Viti Levu, Vanua Levu, and Ovalau, all attest to the great work of atmospheric agencies which has been going on for so long. The separation of islands, islets, or isolated rocks from the

points or spurs of the larger islands also bears witness to the great length of time during which action of the sea necessary to bring about their separation has been at work: adding to this the fact that we are in a region of a former powerful and extensive volcanic activity, the traces of which can still be seen in all directions, forces which have undoubtedly played a great part in the lifting of the island masses and their subsequent shaping to their present outlines.

From this evidence I am inclined to think that the corals of to-day have actually played no part in the shaping of the circular or irregular atolls scattered among the Fiji Islands; furthermore, that they have had nothing to do in our time with the building-up of the barrier reefs surrounding either wholly or in part some of the islands; I also believe that their modifying influence has been entirely limited in the present epoch to the formation of fringing reefs, and that the recent corals living upon the reefs either of the atolls or of the barriers form only a crust of very moderate thickness upon the underlying base. This base may be either a flat or an eroded elevated reef or of a similar substructure of volcanic rocks, the nature of that base depending absolutely upon its character when elevated in a former period to a greater height than it now occupies.

Denudation and erosion act of course more rapidly upon the elevated reef-rocks than upon those of a volcanic character. It is therefore natural to find that the larger islands like Kandavu, Taviuni, and Ovalau are of volcanic origin, while the islands which once occupied the area of the lagoons of Ngele Levu, of the Nanuku reef, of Vanua Mbalavu, of the Argo reefs, of the Oneata, Yangasa, Aiwa, Ongea, and Vatu Leile clusters, being elevated coral-reefs, have disappeared almost entirely, leaving only here and there a small island to attest to the former existence of the more extensive elevated reef once covering the whole area of what is now an atoll. Smaller volcanic islands like Matuku, Moala, Ngau, Nairai, and Koro also show the extent to which each island has been eroded after its elevation, the erosion being least in Koro and Matuku, somewhat greater in Moala and Ngau, and still greater in Nairai. In such atolls enclosing volcanic islands like Mbenga, Wakaya, Makongai, the erosion and denudation have been still greater, these islands covering but a comparatively small part of the area once occupied by the island originally covering the area of the lagoon. Denudation and erosion have been still more active in the Ringgold Islands, in the Kimbobo cluster, and in Komo, and it may have gone so far as to leave no trace in an atoll to indicate

either its volcanic or coral (elevated reef) origin : the shape of the atoll being entirely due to mechanical action, and not being connected in any way with the growth of the corals which have found a footing upon reef-flats formed by atmospheric agencies or by the action of the sea.

So that, as far as we can judge from the case of the Fiji Islands, the shape of the atolls and of the barrier reefs is due to causes which have acted during a period preceding our own. The islands of the whole group have been elevated, and since their elevation have, like the northern part of Queensland, remained nearly stationary and exposed to great and prolonged denudation and erosion, which has reduced the islands to their present height ; the platforms upon which the barrier-reef corals have grown being merely the flats left by the denudation and erosion of a central island of greater size than that now left, while the atolls are similar flats from the interior of which the islands have been eroded and the lagoons of which have been continually scoured by the action of the sea, the incessant rollers pouring a huge mass of water into the lagoon, which finds its way out through the passages leading into it.

In the Fiji Islands the atolls and islands or islets, surrounded in part or wholly by barrier reefs, have not been formed by the subsidence and disappearance of this central island, as is claimed by Dana and Darwin. The Fiji Islands are not situated, as was supposed, in an area of subsidence, but, on the contrary, they are in an area of elevation, so that the theory of Darwin and of Dana is not applicable to the islands and atolls of the Fiji group.

What the age of the elevated reef of the Fiji is I am unable to state ; its aspect and position show it to be of considerable age, probably antecedent to the present period. In many ways it resembles some of the late Tertiary elevated limestones which I have seen on the northern and southern coasts of Cuba. The great thickness which the elevated coral-reefs attain in this group, at least 800 feet, also shows that they may have been deposited originally during a period of subsidence, but not a period of subsidence taking place in our epoch or which could have had any effect in shaping the outline of the islands of the Fiji group and their accompanying reefs.

Whether the elevation of the Fiji group corresponds in time with that of Northern Queensland I am unable to state. I can only suggest that it is not improbable that the elevation of Queensland and of the Pacific islands to the east, New Caledonia, the Loyalty Islands, the Solomon, New Hebrides,

including Fiji and Samoa, may have been synchronous. It may be that these islands have, like Northern Queensland, been subject to an immense erosion and denudation which have reduced them to their present proportions.

The elevation may have been preceded, as in Queensland, in still earlier geological times by a great period of depression, during which the thick beds of coral-reef limestone may have been formed. How far east this elevation extended is not known; its area probably included the Cook Islands and Tahiti, and, judging from some photographs, I should feel inclined to consider atolls of the Paumotu as having been formed by causes similar to those which shaped those of the Fijis.

The evidence thus far collected on the Fijis shows the futility of boring in this group. Any result obtained would merely at some point indicate the thickness of a former elevated reef—a reef formed in a period preceding our own. We should obtain information which could have no bearing on the main question, if I am correct in the interpretation of what I have observed—information, in fact, which may be obtained as one steams along without the trouble or cost of boring. Should I be correct, it would be natural to look upon the results of the boring at Funafuti much in the same light, and to assume that the island, as well as others in the Ellice group, is also in this area of elevation, and that the great thickness of coral obtained was reached by boring in the base of an ancient reef. So that the results obtained by Professor David from the boring at Funafuti do not assist us in any way in corroborating the theory of subsidence as essential to the formation of atolls.

However that may be, it only emphasizes what has been said so often, that there is no general theory of the formation of coral-reefs, either barrier or atolls, of universal application. Each district must be examined by itself—at least such has been my experience in Florida, in the Bermudas, the Bahamas, in Cuba and the West India Islands and the Sandwich Islands. The results of this trip show plainly that the theory of Darwin and Dana, of the formation of atolls and of barrier reefs by subsidence, is not applicable to the Fiji Islands, notwithstanding the boring at Funafuti. In all the localities I have visited the coral-reefs form but a thin crust upon the underlying base (it is not more than 50 to 60 feet thick in Florida), and the shape and slope of this base are in no way due to the growth of the corals living upon it.

This still leaves open the question of the formation of such thick masses of coral-reef rock, which, though they may

originally have been formed by subsidence, as other massive deposits have been, yet may also have been formed by the gradual pushing out to seaward of the outer edge of a reef; the reef increasing both in height (depth) and in width by the constant pushing out of the mass of debris and of blocks detached from the outer edge, forming a talus upon which corals may grow whenever the talus has reached the depth at which they thrive. I am inclined to think that the careful study of such a shore-reef will alone give us a correct idea of the manner in which such thick masses of coralline limestone may have been formed.

There is still another phase in the formation of atolls which has received but little attention. I refer to the formation of atolls as the result of the denudation and erosion of volcanic summits or of extinct craters. There are in the Fiji two extinct craters which are most interesting; one of these is the small extinct crater of Thombia on the Ringgold Islands. The highest point of its rim, the exterior circumference of which is about 2 miles, is nearly 600 feet, and it is continuous with the exception of a small part of its eastern edge, about a fifth of a mile, across which reaches a fringing reef, the extension of the fringing reef surrounding the island. This reef closes the entrance into the crater, which is about half a mile across at the level of the sea and has a depth of 24 fathoms. The other extinct crater is that of the island of Totoya, an isolated peak in the southern part of the group. It is about 6 miles in outer diameter, with an inner basin of 3 miles, and a depth of 34 fathoms. The highest point of the rim is 1200 feet, and at two points it is low, forming in one case a narrow isthmus separating the crater from the outer lagoon. The horns of the open rim are connected by a fringing reef-flat on which thunders the Pacific swell, piling up the water into the great basin of the crater. This water finds its way out through an opening called the "Gullet," which, though narrow, forms an excellent passage to the anchorage inside of the crater. Totoya has not only a fringing reef, but also a barrier reef, somewhat triangular in shape, surrounding the island. It is evident that the barrier reef has been formed upon the denuded and eroded spurs of the island, which once extended seaward from the outer rim of the volcano.

Supposing now that the erosion of both Thombia and Totoya had continued long enough to reduce the rim of these volcanoes to the level of the sea or to form a chain of small islands, we should have, as soon as corals had covered the flats thus formed, which indicate the former existence of the rim, atolls of nearly circular form—the one, that of Thombia,

being quite small, with a circumference of 2 miles and a depth of 24 fathoms, without patches in the central lagoon; the other being much larger, more than 25 miles in circumference, having a depth of 34 fathoms inside the lagoon. The lagoon of the Totoya atoll would be dotted with patches, some of which formed parts of the rim, others being the remains of eroded spurs extending towards the centre of the extinct crater.

There are in Fiji a number of small atolls from 1 to 3 or more miles in circumference, the formation of which, it seems to me, can only be satisfactorily explained on the theory that they have been formed upon the eroded summits or rims of extinct craters, the rim of the volcano having been eroded either to a continuous flat or to flats separated by deeper passages (as in the case of the low parts of the rim of Totoya) forming entrances into the enclosed lagoons. Such atolls are Motua Levu, Motua Lailai, the Adolphus reef, Bell reef, Williamson, Pitman, and the Horseshoe reefs, and Thakau Lakaleka. Of course it is possible that some of these atolls may have been formed from the erosion and denudation of isolated peaks or ridges. It is also possible that some of the larger atolls in which are enclosed volcanic islands, like Vanua Mbalavu, Komo, Motha, Lakemba, Mbenga, the Ring-gold Islands, and others, may represent parts of the rim or ridges and spurs of volcanic peaks and extinct craters which have disappeared by erosion and have left the outer flats upon which the barrier-reef corals have grown; while the deeper valleys and gorges of these now eroded volcanic islands represent the undulations in depths of the lagoons. The depths inside the lagoons vary greatly; in the case of Vanua Mbalavu we find 72 fathoms on parts of the eastern slope of the lagoon. These great depths, far beyond any at which corals can grow, represent the elevated gorges and slopes of the volcanic peaks which probably once extended over the whole area enclosed by the outer reef, during the elevation of which the reef which covered a part of the same area was lifted to its present or even to a greater height.

Such large volcanic centres with extensive craters of considerable depth are not unknown. We can reconstruct conditions from Totoya which would give us an atoll open to the west, with a few islands on the outer rim and a greatest depth of 250 fathoms inside the lagoon. Again, Haleakala in the Sandwich Islands has a crater with a depth of nearly 250 fathoms, while many small volcanic peaks, some fully 1200 feet in height, rise from its bottom. The diameter of Haleakala is fully as great as that of any of the atolls in

Fiji; so that the great depth of the lagoons of some of the atolls can no longer be considered as a proof of the theory of subsidence.

Fulanga is also interesting as illustrating the formation of an atoll by the same causes which have produced the Sounds in the Bermudas. In the case of Fulanga we have a volcanic summit which has raised the elevated coral-reef forming its rim to a height of probably 200 feet. This coral rim has been broken through, and the action of the sea has gradually hollowed out in the interior a circular sound resembling a crater, which is due solely to the disintegration of the inner parts of the elevated reef. In the interior and outer edge of the Sound of Fulanga many parts of this reef still exist as small mushroom-shaped islands or small rounded or conical hills. It is also probable that some of the elevated reef-flats forming the rims of atolls owe their origin to causes similar to those which have shaped the crater-like Sound of Fulanga. This has perhaps been the case with such atolls as Ngele Levu, the Oneata, Ongea, and Yangasa clusters and others.

The great variety of causes which have been active in shaping the present physiognomy of the reefs and atolls of Fiji shows the impossibility of assigning any one factor, like subsidence for instance, as is done by Dana and Darwin, as the single cause for the formation of the many different kinds of atolls and barrier-reef islands to be found in the Fiji group. The formation of the great barrier reef of the southern shores of Viti Levu is due to causes very similar to those which have given to the northern coast of Cuba between Nuevitas and Matanzas its present physiognomy. Along those parts of the island where denudation and erosion proceed rapidly, owing to the soft character of the shore-rocks, very extensive flats have been formed, as those south of Ovalau. When the reef-barrier flats have been eroded from a harder base, like volcanic rocks, the flats are less prominent and somewhat more extensive than when the old elevated coral-reef formed the shore-hills; or the reef-flats may disappear altogether when the harder volcanic rocks have been only little affected by erosion or denudation. From the nature of the negro-heads scattered upon the reef-flats it is generally a simple matter to ascertain the character of the base of the reef-flats of an atoll or of a barrier reef.

We were fortunate in being at Levuka at the time of the appearance of the "Bololo." On the morning of the 17th of November we left the ship at 3 o'clock, bound for a spot named "Bololo" Point, about 3 miles south of Levuka. We had scarcely reached the spot when our guide fished up a few

of the worms, and in a few minutes the water was full of them. Canoes put off from the shore: men, women, and children were wading on the reef with nets and all kinds of utensils to catch "Bololo." With the increase of daylight the "Bololo" became more abundant, and at one time they were so plentiful that the water surrounding the boat was filled with them to such an extent as to resemble thick vermicelli soup. We made an excellent collection of the worms, preserving a large number by different methods. We found, as we had expected, that their sudden appearance was connected with spawning. There were males and females full of sperm and eggs. When in captivity the discharged spermatozoa rendered the water milky, and the masses of eggs were left as patches of dark green granules on the bottom of the dish. The discharge of the eggs and spermatozoa was followed by the collapse of the worms, of which nothing was left but an empty skin scarcely visible. The "Bololo" seems thus suddenly to disappear. The males are light brown or greenish, while the females are coloured dark green. Their activity while swimming about is something wonderful, and the bursting of the animal when it discharges its eggs or spermatozoa is quite a peculiar phenomenon. Dr. Woolworth has made it an object to collect all the material possible in regard to the "Bololo," and on our return he will prepare a paper on this interesting annelid.

I have to thank the State Department at Washington for their kind offices in obtaining for us letters from the Foreign Office to the Government of Fiji. Sir George O'Brien, the High Commissioner for the Western Pacific, gave us all possible facilities for visiting the different islands of the group. I am also indebted to the Hon. Charles Stuart, the Colonial Secretary, and to the Hon. W. L. Allardyce, assistant native Commissioner, for assistance and advice. To Dr. Corney and the Hon. John Berry I owe information regarding the presence of elevated reefs at various points I had not examined. To Captain D. Calder I am greatly indebted for his interest in our behalf. We were fortunate in retaining the services of Captain Robert Cocks as pilot during our expedition. His knowledge of the reefs is accurate and extensive. Finally I have to thank Captain Thomson, as well as the officers and crew of the 'Yaralla,' who have been indefatigable in our interest.

I hope during the coming summer to prepare a fully illustrated report of this interesting cruise. . . .

XXXVI.—*Description of a new Bat from North Borneo.*
By OLDFIELD THOMAS.

Hipposiderus sabanus, sp. n.

Size small. Head short and blunt. Nose-leaf exceedingly reduced, smaller than in any described species, the horseshoe covering scarcely a third of the top of the muzzle. Front surface of posterior transverse leaf not divided by vertical bands; horseshoe narrowing forwards, the middle of its anterior edge sharply notched; no secondary leaflets present. A small transverse frontal gland (in female). Ears rather small, their tips evenly rounded, the anterior margin straight or faintly concave above, the posterior convex throughout. Wings from the metatarsus; tip of tail projecting about 3 millim. Colour (in spirit) uniform dull brownish above and below.

No minute upper premolar present; the large premolar pressed close against the back of the canine; the tips of these two teeth only 0·8 millim. distant from each other.

Dimensions of the type (an adult female in spirit) :—

Forearm 38 millim.

Head and body 43; tail 26; head 16·6; nose-leaf $5 \times 3\cdot7$; ear 15; lower leg 17; calcar 7.

Hab. Lawas, N. Borneo. Coll. A. H. Everett.

This peculiar little species differs strikingly from every known *Hipposiderus* by the extreme reduction of its nose-leaf, while in the absence of its anterior upper premolar it is alone resembled by the African *H. megalotis*.

XXXVII.—*Description of a new Echimys from the Neighbourhood of Bogota.* By OLDFIELD THOMAS.

IN two previous communications to the 'Annals' * I have, in default of really typical specimens, accepted an *Echimys* from the neighbourhood of Bogota as representing Tomes's *E. semispinosus*, described from Ecuador †. Now, however, among some specimens recently presented to the Museum by the Zoological Society, at whose rooms they had been lying over-

* Ann. & Mag. Nat. Hist. (6) xviii. p. 312 (1896), xx. p. 551 (1897).

† P. Z. S. 1860, p. 265.

looked for many years, there is a dark brown *Echimys* marked, in what appears to be a handwriting similar to that on some of Fraser's labels, "*Echimys semispinosus*." This so precisely agrees with Tomes's description of that animal, that there can be no reasonable doubt that it is one of the original specimens collected by Fraser and referred to in Tomes's paper. On no other hypothesis can the occurrence of the name, in a handwriting not that of any English mammalogist, on a specimen found in the Zoological Society's rooms be accounted for.

A comparison of this animal with the Nicaraguan, Bogotan, and Trinidad species shows that it is most nearly allied to the first-named, from which it differs by its much darker colour, its broader nasals (which exceed to a greater extent the premaxillary processes), its parallel-sided palatal foramina, and other cranial details. Its hamular processes are of the same spatulate shape.

The Bogotan species is, on the other hand, most nearly allied to *E. trinitatis*, but is specifically different, and may be called

Echimys chrysæolus, sp. n.

Size about as in *E. trinitatis*. Spines, as in the other members of the present group, restricted to the anterior two thirds of the body, the rump being quite soft-haired. Spines about 15 millim. in length by about 1.3 in greatest breadth. General colour above coarsely mixed yellow and black, the lining very heavy, and the contrast between the two colours very marked. Face, sides, and rump more brown and yellowish, producing a very dull tone compared with the rich rufous of *E. trinitatis*. Under surface pure sharply defined white; no darker half-collar present. Hands and feet white, irregularly mixed with brown along their outer halves. Tail shorter than in *E. trinitatis*, fairly well haired, blackish above, white below.

Skull in many ways very similar to that of *E. trinitatis*; the muzzle is, however, broader and more conical (as in *centralis* and *semispinosus*), the supraorbital ridges, instead of gently curving outwards as they pass backwards, curve abruptly and strongly, attaining over the squamosals a much greater distance apart. Outer corners of interparietal with little ridges running forwards to lose themselves on the surface of the brain-case some way above where those that run back from the supraorbital ledges also disappear. In *centralis* and *semispinosus* these ridges are continuous with one another; in *trinitatis* the interparietal ridges are scarcely

perceptible and the supraorbital ones end off earlier. Hamular processes of pterygoids narrow, scarcely more than 1 millim. broad, while they are broadly spatulate in *semi-spinosus* and *centralis*, and in *trinitatis* they are triangularly broadened, with a supplementary process running vertically upwards and nearly touching the basisphenoid.

Dimensions of the type (an adult female, measured in skin):—

Head and body (c.) 260 millim.; tail (c.) 161; hind foot, without claws 46·5, with claws 50·5.

Skull: extreme length 59; basilar length 40·7; greatest breadth 28·5; nasals 21·2 × 6·7; interorbital breadth 13; greatest breadth on supraorbital ledges above squamosals 22; interparietal 8 × 13·4; palate length from henselion 20; diastema 12·2; palatal foramina 5·1 × 3·6; length of upper molar series 8·2; breadth between bullæ on basilar suture 3·7.

Hab. Muzo, N. of Bogota, Colombia. Collected by a native, Dec. 24, 1895.

Type: B.M. 98. 2. 7. 2.

Besides three specimens from the typical locality there are examples from "La Isla" and "El Guamito" in the same part of Colombia, while a young specimen (apparently identical) has also been received from the neighbourhood of San Cristoval, Tachira, W. Venezuela.

XXXVIII.—*Descriptions of Three new Species of African Butterflies in his own Collection.* By H. GROSE-SMITH.

Pinacopteryx narena.

Male.—*Upperside* pure white; anterior wings with the base, costal margin, and the apex (rather broadly) black.

Underside. Anterior wings white, with the apex creamy white; a minute black spot at the end of the cell, and a round greyish-brown spot on the disk between the two upper median nervules. Posterior wings rather dusky creamy white, tinged with pale orange at the base; a row of six small brownish-grey spots crosses the middle of the disk between the veins, and there is a minute brownish-grey spot on the upper discocellular nervule.

Expanse of wings $1\frac{3}{4}$ inch.

Hab. Antanossi country, S. Madagascar (*Last*).

Allied to *P. charina*, Boisd., and *P. simana*, Hopff.

Mylothris flaviana.

Male.—*Upperside* differs from *M. ochracea*, Auriv., in the colour of the wings, which are uniform yellow, not ochraceous, and in the broader greyish-black apex of the anterior wings.

On the *underside* the dark apical area of the anterior wings is restricted to half the area of the dark markings on the upperside.

Expanse of wings $2\frac{1}{8}$ inches.

Hab. Cameroons.

Neptis callina.

Upperside. Both wings dusky brown; anterior wings crossed beyond the cell by a broad white band, placed rather obliquely and extending from the subcostal nervure at the middle to the lowest median nervule; the upper part of the band at the end of the cell curves abruptly inwards, the lower part of the band being narrower and indented on its outer edge; a rather large white patch on the middle of the inner margin, extending upwards to the lowest median nervule; beyond the band towards the apex are three narrow hastate white markings, and traces of a fourth, enclosing a row of conical spots darker than the ground-colour, followed by two submarginal brownish-white lines, divided by the veins; the cell is crossed beyond the middle by three dark lines and a V-shaped marking towards the base, the spaces between which are paler than the ground-colour. Posterior wings crossed about the middle by a broad white band, the inner edge of which is regular and the outer edge is indented; towards the outer margin between the veins is a row of conical spots, darker than the ground-colour, bordered on either side by dusky white lines, followed by a submarginal row of narrow lunulate dark bars, narrowly bordered on each side by dusky white lines; the cilia on both wings between the veins narrowly white, the veins where they cross the white bands being also white.

Underside brighter and paler brown than above, with the white spots and lines much brighter; on the anterior wings the ground-colour of the cell is brownish white, and on the posterior wings there is a broad white streak above the costal nervure.

Expanse of wings $1\frac{3}{4}$ inch.

Hab. Cameroons.

XXXIX.—On a small Collection of Mammals made by
Mr. C. V. A. Peel in Somaliland. By W. E. DE WINTON.

(1) *Macroscelides Revoilii*, Huet.

a. Lehello (4500 feet), 65 miles south of Berbera.

This single specimen is not fully adult, having the milk-teeth still in place.

(2) *Crocidura* (Cr.) *nana*, Dobs.

a, b. Eyk (4500 feet), 4th July.

As the dimensions of the skull of this, the smallest true *Crocidura* known, have not been published, some of the principal measurements are here given.

Greatest length 16 millim.; breadth 7; basal length 14.5; front of incisors to back of palate 7.5; entire tooth-row 6.5; tip of incisor to tip of large premolar 3.5; mandible, tip of incisor to condyle 9.7, to angle 10, angle to coronoid 4.9.

(3) *Herpestes ochraceus*, Gray.

a. Abori (5000 feet), 7th July.

Mr. O. Thomas, in a revision of this group (P. Z. S. 1832, p. 69), makes of this form his "variety *d*" of *H. gracilis*; but with further material and entire skulls, instead of the mutilated specimens then in the Museum, it is now shown to be a distinct species.

Size smaller than *H. gracilis*; colour ochraceous red or bright rusty on the dorsal surface, paler on the sides; fur less annulated with blackish. It is also smaller than *H. Grantii* from Zanzibar, but has rather more annulations on the fur. The size of the teeth and the much shorter and more rounded skull distinguish it from either of the above species.

The specimen contained in this collection being a flat skin, the measurements given below are taken from another individual in the British Museum, ♂ (no. 97. S. 9. 7), Mandeira, Somaliland, collected and presented by Dr. A. E. Atkinson:—

Head and body (c.) 290 millim.; tail (c.) 245; hind foot 52.

Skull: greatest length 57; breadth 31; brain-case 25.5; basal length 54; length of entire tooth-row 24; greatest breadth outside teeth 20.3; length of carnassial tooth (outer side) 5.5; breadth of first molar 6.2, breadth of second molar 4.4; mandible, length (bone only) to condyle 37, to angle 37.1.

The most marked differences in the skull compared with *H. gracilis* are its shortness, the less developed occipital and sagittal crests, the postorbital processes not joining, the shorter tooth-row (measurement of entire tooth-row about equalling that from the front of the canine in *H. gracilis*), teeth individually smaller (especially the carnassial and first molar), last molar longer in proportion to the first, and the greater vertical depth of the auditory bullæ; in the mandible the most striking difference is the much shorter angular process, the measurements from the front of the jaw to the condyle and to the angle being practically equal.

(4) *Ictonyx erythræa*, sp. n.

Size smaller than the Cape Zorilla (*I. zorilla*). Colour and pattern of the markings generally as in that species; the suboral white patch, however, is rather more extensive, and the black dorsal stripe does not widen out quite so much over the loins.

The specimen contained in the present collection was obtained at Habr Heshi (4000 feet), Marehan Country, S.E. Somaliland, Aug. 24th. This being a flat skin, it is thought advisable to select as the type of the species another example from the collection of the British Museum (no. 93. 6. 7. 4), ♀, from Suakin, presented by Surg.-Capt. R. H. Penton.

Measurements (taken from dried skin):—

Head and body (c.) 335 millim.; tail (c.) 255; hind foot (c.) 46.

Skull: greatest length 55.5; greatest breadth 33.5; brain-case 28.9; intertemporal constriction 14.5; basal length 51; length of entire tooth-row 21.5; greatest breadth outside teeth 20; length of carnassial (outside) 6; breadth of molar 6; mandible, length (bone only) to condyle 34.5, to angle 33.2.

The shape of the skull generally as in *I. zorilla*, differing only in size. The front of the palate is scooped out, forming a shallow sinus, in which the incisive foramina are placed. The carnassial tooth is shorter in proportion and the molar narrower, especially internally.

The specific name chosen is intended to express some idea of the range of this species. The third form of this group, *I. senegalensis*, extends across the continent to Lado on the Nile, and into British East Africa as far as Machakos, where it has been obtained by Mr. F. J. Jackson.

(5) *Canis lupaster*, Hempr. & Ehrenb.

a. Edegan (5000 feet), 130 miles south of Berbera, 20th June.

(6) *Otocyon megalotis*, Desm.

a. Lehello, 10th June.

(7) *Xerus dabagala*, Heugl.

a. Lehello, 12th June.

Dr. Jentink, in his well-known revision of the African squirrels ('Notes Leyden Museum,' 1882, p. 41), gives this name as a synonym of *X. rutilus*; this, I think, is not doing justice to a form so strikingly different in coloration. The form described by M. Milne-Edwards (Rev. et Mag. Zool. 1867, p. 229) as *X. flavus* belongs no doubt to the present species.

(8) *Gerbillus ruberrimus*, Rhoads (?) = *G. pusillus*, Peters.

a. Bally Maroli (5000 feet), a little to west of Eyk.

I use the above name for this Gerbil as it has been applied to an animal from an adjacent locality; at the same time I am not at all sure that it is in any way distinct from *G. pusillus*, Pet., which comes from Taita in British East Africa.

(9) *Gerbillus imbellis*, sp. n.

Size medium; colour rich dark fawn, most of the hairs on the back tipped with black, sides purer; bases of the hairs on the back and the top of the head slate-coloured; all the underparts pure white; on the eyebrows, cheeks, and front of fore legs the white hairs are tipped with fawn; the white spots at the base of the ears and above the eyes distinct; tail darker above than below, rather sparingly haired; feet not very thickly covered with white hairs; nails darkish horn-colour; soles, toes, and pads very pale, closely covered with very conspicuous scale-like granulations; the toes have a few stiff white hairs on the lower side; pads and soles quite naked.

Type labelled "Goodar (4500 feet), July 14th."

Measurements (taken from the dried skin):—

Head and body (c.) 110 millim.; tail? (broken); hind foot (c.) 26·5; ear (c.) 14.

Skull: greatest length 32·5; greatest breadth 16·5; nasals 13·2 × 2·9; interparietal 4 × 9·5; basal length 26; hensenion to back of palate 14; incisive foramina 5·7; palatal foramina 0·9; length of molar series 4·6; width outside ^{ms. 1} 7·3, width outside ^{ms. 3} 5·3; mandible, length (bone only) to condyle 17, to angle 14; height, standing on table, perpendicularly to condyle 7·5.

The nasals are slender, of uniform width throughout; the front roots of the zygomata are not extended far forward, the length being 5.1 millim. The molar series are strongly convergent from before backwards; ms.³ is small, with no posterior cusp. The palatal foramina are small, placed opposite the third interior cusps of ms.¹ and the first cusps of ms.². The mandible is exceedingly weak and low, the ascending ramus sloping backwards at a very obtuse angle from the molars to the condylar process, with no coronoid process whatever; angle short, not reaching backward more than halfway between the molars and the condyle.

The extraordinary weakness of the lower jaw suggests the specific name that is given, Gerbils being noted for fighting among themselves.

It will be interesting to know upon what this animal lives, for its food can hardly be of the same nature as that of the family generally.

(10) *Gerbillus Peeli*, sp. n.

Size small; colour above rich fawn, most of the hairs tipped with blackish, the bases of the hairs slate-coloured; all the underparts, to the bases of the hairs, pure white; feet and hands well clothed with white hairs; nails horn-coloured; fingers and toes sparingly covered with hairs on the lower sides, soles and pads quite naked; tail bicoloured, blackish brown above, deepening in intensity towards the tip, buffish white beneath.

Type labelled "Eyk (4500 feet), 4th July."

Measurements (taken from the dried skin):—

Head and body (c.) 70 millim.; tail (c.) 50; hind foot (c.) 24.

Skull: greatest length 26; greatest breadth 14.5; nasals 9.2 × 2.1; interorbital constriction 4, interparietal 4.2 × 6.5; basal length 21; incisive foramina 4.6; palatal foramina 3.1; molar series 3.8; outside ms.¹ 5, outside ms.³ 4.7; mandible, greatest length, condyle to back of incisors 14.1, angle to back of incisors 12.

The skull is peculiarly square and short and unlike any other Gerbil I know, the zygomatic processes starting out very abruptly in front, recalling the skull of *Malacothrix*; the nasals, however, are short; the bullæ are rather large and very thin in texture. The palate is peculiar, the palatal (in distinction to the incisive) foramina being unusually large, commencing a little in front of ms.¹ and extending back to about level with the middle of ms.²; foramen magnum some-

what compressed between the large bullæ, much higher than broad; the molar series not converging appreciably posteriorly; posterior cusp of m^3 large, occupying more than a third part of the surface of the whole tooth.

I have great pleasure in associating the name of the collector with this very interesting new form.

(11) *Pectinator Spekei*, Blyth.

a. Lehello, 10th June.

(12) *Lepus somalensis*, Heugl., or *L. berberanus*, Heugl.

a. Lehello, 12th June.

Perhaps the specimen in the present collection agrees best with the description attached to the latter name; but as I have not had an opportunity of seeing the types, I am unable to say if they are really distinct species.

The upper incisors have the grooves entirely filled with cement level with the surface.

XL.—*Descriptions of Three new Rodents from Africa.*

By W. E. DE WINTON.

Anomalurus Jacksoni, sp. n.

Closely resembling *A. cinereus* in size and colour, but distinguished by having a black muzzle, a black ring round the eyes, and a large black spot behind the ear (all these characters are found in the West-African brightly coloured species *A. erythronotus*); a still more interesting outward distinction is the greater extension of the soft fur on the upperside of the wings, the rigid appressed hairs being confined to a small space barely 2 inches long from the point of the expanding process backwards; there is not so much white on the underside of the neck and no white band from ear to ear, and the undersides of the fore and hind legs are dusky, and not clear white as in *A. cinereus*.

Type (♂), Ntebe, Uganda, 6th Oct., 1895. Collected by Mr. F. J. Jackson, H.M. Acting Commissioner in Uganda.

Measurements (taken from the dried skin):—

Head and body (c.) 320 millim.; tail (c.) 200; hind foot (c.) 53; ear (c.) 32.

Skull: greatest length 58; greatest breadth 38.5; greatest length of nasals (diagonally of one bone) 15.5; narrowest

across both bones 5·5; across interorbital space at suture of lachrymals and frontals 18; intertemporal constriction 14·6; infraorbital foramen, height 6·5, breadth 3·7, basal length 51; molar series 13; diastema 12; mandible, length (bone only), back of incisors to condyle 33·5, to angle 35, to coronoid 29; height, standing on table, perpendicularly to coronoid 19, to condyle 17·1.

Compared with the skull of *A. cinereus* (measurements of which, so far as it is possible, are given below), the maxillary processes of the zygomata do not spring out so abruptly, the supraorbital ledges slightly and gradually narrow posteriorly, with less distinct processes in the temporal portion; the nasals are rather longer; the posterior portions of the nasals, premaxillary and maxillary processes being subequal in breadth and evenly rounded off, the frontal suture forms a row of even scallops; the lachrymal bones are rather longer on the frontal surface, the infraorbital foramina are smaller, the molars broader and more rounded, and the incisive foramina smaller. The auditory bullæ are rather large.

A. cinereus, Thos.—Very few measurements are possible, the skull being very imperfect. Length of nasals 13 millim.; narrowest breadth 5·7; interorbital breadth 16·5; intertemporal constriction 15; infraorbital foramen 6·7 × 4·2; molar series 13; diastema 12; mandible, inner side of back of incisors to condyle 33, to coronoid 26, to angle 33·5.

Nasals short; supraorbital ledges not converging from the front, ending posteriorly in well-marked processes; zygomata springing out very abruptly in front; the nasals, which are blunt, barely reach back as far as do the processes of the premaxillæ, and are not quite so broad as these processes, so that the frontal suture has not the scalloped appearance which is so striking a feature in *A. Jacksoni*.

As some of the outward characters of this new *Anomalurus* resemble *A. erythronotus*, it would be well to mention the most striking differences between the skulls. The new form differs in the maxillary portion of the zygomata being stronger and the infraorbital foramina smaller; in the longer and narrower processes of the premaxillæ, which in *A. erythronotus* stop considerably short of the back of the nasals; in the less-developed processes terminating the frontal ledges; the auditory bullæ are considerably larger and rounder; the molar series longer and the teeth much heavier. The single specimen has no free pterygoid processes, the bones show no sign of fracture, being smoothly rounded off. In the

mandible the distance between the coronoid and condyle is shorter, and the molars much broader and heavier.

Gerbillus (Tatera) Phillipsi, sp. n.

Colour of the upper parts fawn; most of the hairs on the top of the head and on the back are tipped with dusky; scarcely any sign of eye- or ear-patches; the fur grey at the base, except on the eyebrows and cheeks; all the underparts to the base of the fur, with the feet and hands, pure white; the tail is bicoloured, much like the back above, white beneath; the feet and hands are not very thickly covered with hair, and the tail has only short hair upon it, about as in *G. afer*. The pads of the fore feet (in the dry skin) are darker than the soles generally, and the soles and pads of the hind feet are dusky brown or almost soot-coloured. The soles of the hind feet are reticulated in the distal and padded portions, smooth in the metatarsal. In outward appearance, especially in colour, more nearly resembling the true Gerbils than any known species of the group to which it belongs.

Type in the British Museum (no. 97. 12. 3. 7), "Hanka Dadi, Somali, 8th March, 1897, trapped on sandy bank." Collected and presented by Mr. E. Lort-Phillips.

Measurements (taken in the flesh):—

Head and body 120 millim.; tail 163; hind foot 32; ear 20.

Skull: greatest length 38·5; greatest breadth 20·1; across the front of the zygomata 14·6; nasals, length 16, interparietal bone 4·5 × 9·3, basal length 32; incisive foramina 8; palatal foramina 2·7; upper molar series 6; outside ms.¹ 7·7, outside ms.³ 7·1; mandible length (bone only) to condyle 20, to coronoid 16, to angle 20·3; height, standing on table, perpendicularly to coronoid 9·7, to condyle 9·9.

The skull resembles those of its allies in general shape; the nasal bones are, however, considerably longer in proportion—in fact, the actual length of these bones is only equalled in *G. murinus*, which is a much larger animal; the auditory bullæ are rather more rounded than in either *G. afer* or *G. leucogaster*. The incisors are narrow, as are also the molars; the last molar is trefoil-shaped.

Georychus Lugardi, sp. n.

Colour seal-brown, with a small white spot on the crown of the head. The colour is not unlike that of *G. Lechei* from

Monbuttu, but rather browner, and the large white blaze distinguishes that larger species. The skull most nearly resembles *G. Bocagei* from Angola in having a very broad facial portion and in the nasals ending in a point level with the back of the intermaxillary processes; the zygomata are, however, much lighter, the inner surface is perpendicular and not turned upwards, and the maxillary processes do not spring out so abruptly; the infraorbital foramina are very small, not more than 1 millim. high and $\frac{1}{2}$ millim. broad; the teeth are large in proportion; the auditory bullæ rather fuller than in most of its allies. In the mandible the coronoid processes are very much shorter and further from the condyle; the intermediate space is level, being in this respect more like *G. Darlingi* from the Salisbury Plateau of Mashunaland.

The type (no 97. 12. 5. 2 in the British Museum) was collected and presented by Major F. D. Lugard, D.S.O., C.B., who obtained it in the Kalahari Desert between Palapye and Ngami.

Measurements (taken from the dried skin):—

Head and body (c.) 130 millim.; tail 13; hind foot 25.

Skull: greatest length 34; breadth of brain-case 14·6; nasals $12 \times 3\cdot2$; breadth of facial portion 8·3; intertemporal constriction 8; basal length 30; molar series 7·5; mandible, back of incisors to back of condyle 22·5, to coronoid 14·5.

Major Lugard also brought home a Galago (*Galago maholi*) taken at Palla, Bechuanaland Protectorate, which adds to our knowledge of the range of this species.

XLI.—*On the Habitat of the Siluroid Fish Anoplopterus platychir, Gthr.* By G. A. BOULENGER, F.R.S.

AMONG some fishes collected in Northern Nyassaland, between Kondowe and Karonga, by Mr. A. Whyte, and presented to the British Museum by Sir H. H. Johnston, I was rather surprised to find two specimens of a catfish of the genus *Anoplopterus*, Pfeffer, which, instead of being referable to the recently described East-African *A. uranoscopus*, Pfeffer, agreed in all respects, except their larger size (75–80 millim.), with Günther's *A. platychir*. The fish was originally described, from Sierra Leone specimens, as a *Pimelodus*, from which genus *Anoplopterus* differs in the absence of an ocular rim and of any trace of ossification in the first dorsal ray. Almost at the same time the fish reached me a paper

was published by Vaillant (Bull. du Mus. 1897, p. 81) describing apparently the same species from Mrogoro torrent, Urugaru Mountains, E. Africa, as a new genus named *Chimarrhoglanis Leroyi*, the author overlooking Pfeffer's publications on the fishes of East Africa (Jahrb. Hamb. Wiss. Anst. vi. 1889, pt. 2, and x. 1893; and Thierw. O.-Afr. Lief. v. 1896).

I think the identification of the genera established independently by Pfeffer and Vaillant cannot be disputed. It is also evident that *A. uranoscopus* is a species distinct, though closely related to *A. platychir*, from which it is distinguished by a more elongate body, over five times the head-length, and longer maxillary barbels reaching to halfway between the head and the dorsal fin. But in view of the fact that *A. platychir* is stated to be from Sierra Leone, and as it seems improbable that so specialized a form should occur at such distant points in Africa, I have very carefully compared the new specimens, as well as Vaillant's description, with the types in the British Museum, without being able to detect any difference by which their separation could be justified*. I must add, however, that the specimens labelled as from Sierra Leone have no history attached to them, no collector's name—in fact, have never been entered in the Museum register. I would therefore suggest the probability of the locality assigned to them being erroneous, and express my belief that the only known habitat of *Anoplopterus platychir* is the hill-streams of East Africa and Nyassaland, and that *A. platychir* represents the young and *A. Leroyi* the adult of one and the same species.

BIBLIOGRAPHICAL NOTICE.

P. BUBANI. *Flora Pyrenæa per Ordines Naturales gradatim digesta*. Opus posthumum editum, curante O. PENZIG. Volumen primum.

THIS is a bulky book of 550 pages plus the index of genera dealt with. The Latin preface runs to 33 pages. It would be difficult to calculate, from ground already covered in this first volume, how many more volumes will still be needed to complete the work. A mere cursory glance, however, is sufficient to prove the ability and

* The vent is, however, anterior to the posterior third of the body, not posterior as stated by Vaillant.

industry of the author, although his methods are not likely to be adopted by practical botanists. Philological, antiquarian, and other discussions of length occur constantly, and seem altogether out of place in a modern Flora. A case in point may be found under *Helaine Dioscoridis*, which, by the way, is the correct name (*vide* Bubani) of the Linnean *Parietaria officinalis*. "Quid est *Perdium*, Theophr. Hist. pl. c. 11?" Then follows a dissertation of some twenty lines, which doubtless would appeal to the classical scholar, but which most botanists would dismiss as useless. *Viscum album* (our mistletoe) becomes, with Theophrastus, Dioscorides, and Pliny as his authorities, *Stelin album*, Bubani. Holy Writ is frequently appealed to, and *Quercus vulgaris*, Bibl. Sacr. Genesis, chapt. xxxv. v. 8 (?), does duty for our common British *Q. pedunculata*. We do not know Hebrew, but it seems absurd to state (even if the assertion be queried by its maker) that the following verse gives us any information as to the species of oak meant:—"But Deborah Rebekah's nurse died, and she was buried beneath Bethel under an oak: and the name of it was called Allon-bachuth." Of the three common European Poplars, Theophrastus, Homer, and the Bible are respectively quoted as the authorities for *Populus tremula*, *P. nigra*, and *P. alba*. The descriptions given in the works cited by Dr. Bubani are certainly insufficient to enable us to determine the species.

The treatment of *Prunella vulgaris* occupies seven pages. There is neither here nor elsewhere in the book any specific descriptions, but full synonymy and citations are given, as well as localities, and critical notes on the structure and affinities &c. of the plant.

But we cannot conclude our notice of this remarkable work without quoting a learned critic, who writes:—"A volume of such learning and erudition, and one so accurately compiled, must, in spite of its eccentricities, have a warm welcome in the botanist's library." G. N.

MISCELLANEOUS.

Note on Pamphila gonessa, Hew. By F. A. HERON.

THE name of this species is, as mentioned by Dr. W. J. Holland in his paper on the African Hesperidiids (Proc. Zool. Soc. 1896, p. 102), omitted from Kirby's list of the Hewitson collection, but the type itself is in the collection under *cretucea*, Snellen, of which it is a synonym.

Beneath the specimen the pin bears the labels "*gonessa*, Hew." (in Hewitson's own writing), and "Angola" (printed); but these names are not visible unless the insect is reversed.

No. 345 of Holland's list is therefore only an additional synonym of his no. 149.

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XLII.—*Report on a Collection of Fishes from Newchwang, North China.* By Dr. A. GÜNTHER, F.R.S.

[Plate XIII.]

DR. W. MORRISON, who, after a long residence at Newchwang in Manchuria, has recently returned home, has brought a small collection of well-preserved specimens of fishes which are usually sold in the market for food. They are caught in the river and estuary of the Liao-ho, and are the first which are described from that river. The number of species is twenty-two, nearly all of which are known to occur also in the waters of the southern coast of the Gulf of Pechelee and in the rivers still further south. On the other hand, although the tributaries of the Liao-ho are separated from those of the Amur by a watershed in places under a mile in breadth, the fish-faunas of these two systems seem to be very different, to judge from Dybowsky's descriptions of the Amur fishes. No Salmonoids from the Liao-ho were ever seen by Dr. Morrison; those sold at Newchwang (and they were in large quantities) came from the Amur.

Another point of interest attached to this collection was that it contained species evidently seen and figured by Basilewsky, who obtained the materials for his paper in *Nouv. Mém. Soc. Impér. Nat. Moscou*, 1855, chiefly at Pekin,

where immense quantities of fishes are imported in a frozen state from the coast as well as from Mongolian and Manchurian rivers.

Lateolabrax japonicus, Schleg.

Chinese: *Lu-yu*.

Labrax ly-iuy (Basilewsky, N. Mém. Soc. Imp. Nat. Mosc. x. 1855, p. 219) is evidently the same fish as the one first described from Japanese specimens. Basilewsky, indeed, speaks of denticulations on the tongue—" *Lingua libera ad basin aspera denticulata* "; but this remark clearly refers merely to the asperities behind the tongue, on the basi-branchials.

Sciæna tenlo.

Sciæna tenlo, Basil. Nouv. Mém. Soc. Imp. Nat. Moscou, x. 1855, p. 220, tab. iii. fig. 1 (erroneously named *Pagrus magrocephalus*).

D. 10 | $\frac{1}{26-30}$. A. 2/7. L. lat. ca. 70*. L. transv. 7/20.

The length of the head is nearly equal to the height of the body, which is contained $3\frac{1}{2}$ times in the total length (without caudal). The diameter of the eye is two elevenths of the length of the head, less than the length of the snout, and much less than the width of the interorbital space. Snout moderately swollen, overlapping the lower jaw, which shows five distinct symphyseal pits. Maxillary extending beyond the middle of the eye. Præopercular margin armed with spines. Dorsal spines slender, moderately long. Anal spine strong, two thirds of longest ray. Caudal fin obtusely rounded. Pectoral fins longer than ventral, two thirds of the length of the head. Oblique greyish lines running along the series of scales; spinous dorsal fin blackish; each dorsal ray with a black spot at the base.

The specimen in Dr. Morrison's collection, about 20 inches long, is well preserved, and agrees so well with Basilewsky's figure that the latter might have been drawn from it. The Chinese name, *T'ung-lo-yu*, as given by Dr. Morrison, agrees likewise with that mentioned by Basilewsky. There is an unfortunate confusion in the lettering of the illustrations in the Russian memoir. The actual lettering of our fish is "*Pagrus magrocephalus*, tab. iii. fig. 1," while the name

* The scales along the lateral line are very irregular; I have endeavoured to indicate by this figure the number of transverse rows of scales above the lateral line.

belonging to our fish is transposed to the species of "*Pugrus*" on tab. i. fig. 3.

This species of *Sciæna* is allied to *Sciæna coitor*, to which I referred some young and badly preserved specimens from Reeves's collection in 1860 (Cat. Fish. ii. p. 301); but, for the present at least, both forms had better be kept distinct. Materials such as were at that time at my disposal, and, I believe, at that of my predecessors, are quite insufficient for a critical delimitation of the species in a family in which the species are so closely allied and so indistinctly described as in the *Sciænidae*.

Also a very young specimen in a bad state of preservation, sent by Swinhoe from Chefoo, which I thought might be referred to *Sciæna Dussumieri* (Ann. & Mag. Nat. Hist., Feb. 1874, p. 155), seems to belong rather to *Sciæna tenlo*.

Sciæna crocea.

Sciæna crocea, Richardson, Ichthyol. China and Japan, p. 224 (1846);
Gunth. Cat. Fish, ii. p. 284.

Sciæna chuam-chua, Basilewsky, Nouv. Mém. Soc. Imp. Nat. Mosc. x.
1855, p. 221.

D. 10 | $\frac{1}{33-34}$. A. 2/7. L. lat. 63. L. transv. 5/14.

The height of the body is nearly the length of the head, which is two sevenths of the total length (without caudal). The diameter of the eye is two elevenths of the length of the head, less than that of the snout, and much less than the width of the interorbital space. Snout scarcely swollen, with the lower jaw a little projecting, approaching in form that of *Otolithus*. The teeth in the upper jaw are short, forming a single series, no one being differentiated by size, but they are larger than those of the lower jaw. Lower jaw without pits. The maxillary does not extend to below the hind margin of the orbit. Pæopercular margin membranaceous, with indistinct crenulations. Dorsal spines feeble; anal spine short, but pungent. Caudal fin slightly produced in the middle. Pectoral fins longer than ventral and as long as head without snout. Coloration uniform silvery.

The specimens from which this description is taken are 12 inches long. Dr. Morrison enumerates them under the names of *Huang hua yu* and *Huang liu yu*, of which, although somewhat differently spelled, the former agrees with the vernacular names given by Reeves and Basilewsky.

Collichthys lucida, Rich.

A young specimen.

Vernacular name: *Ta tou pao yu*.

Cybiium gracile.

Cybiium gracile, Günth. Ann. & Mag. Nat. Hist., Nov. 1873, p. 378.

First described from Chefoo.

Vernacular name: *Pa-yu*.

Platycephalus cultellatus, Rich.

Vernacular name: *Chien tou yu*.

Gobius hasta, Schleg.

Vernacular name: *Pan tou yu*.

Mugil so-iuy.

Vernacular name: *So-yu*.

Mugil so-iuy, Basilewsky, Nouv. Mém. Imp. Soc. Nat. Moscou, x. 1855, p. 226, tab. iv. fig. 3; Günth. Ann. & Mag. Nat. Hist., Feb. 1874, p. 157.

D. 4 | $\frac{1}{8}$. A. $\frac{3}{8}$. L. lat. 41. L. transv. 14.

Allied to *Mugil axillaris*.

The height of the body is contained in the total length (without caudal) $5\frac{1}{3}$ times, the length of the head $4\frac{2}{3}$. The diameter of the eye is contained in the length of the head $5\frac{1}{2}$ times, the width of the interorbital space $2\frac{1}{2}$. Adipose eyelid not developed; the præorbital is emarginate and distinctly denticulated; snout longer than the orbit; upper lip thin; extremity of the maxillary not hidden. There are twenty-three scales between the snout and the first dorsal fin; no elongate scale in the axil. Dorsal fins nearly equal in height; the spines are rather slender, and the first is rather shorter than the postorbital portion of the head; its root is a little nearer to the snout than to the base of the caudal fin. Neither the dorsal nor the anal fins are scaly, the latter commences distinctly in advance of the soft dorsal. Caudal emarginate. Pectoral as long as the head, without snout. Coloration uniform.

The specimen from which this description is taken is 11 inches long. Basilewsky's figure is incorrect in many respects, especially as regards the position of the first dorsal

fin. He mentions the eyes as "*nictitantes*"; but this seems to refer merely to the circular eyelid, which covers only the margin of the orbit, as also shown in the figure.

Cynoglossus semilævis.

Cynoglossus semilævis, Günth. Ann. & Mag. Nat. Hist., Nov. 1873, p. 379.

Vernacular name: *Ta ta-pan yu.*

The specimen, 16 inches long, differs somewhat from the type; I count 124 rays in the dorsal and 98 in the anal fin; 23 rows of scales between the upper and middle, and 28 between the middle and lower lateral lines. No spots on the blind side.

Cynoglossus gracilis.

Cynoglossus gracilis, Günth. Ann. & Mag. Nat. Hist., Sept. 1873, p. 244.

Vernacular name: *Hsiao ta-pan yu.*

Also in this specimen, which is 11 inches long, the numbers of the fin-rays and scales vary slightly from the type, the dorsal fin showing 136 rays and the anal 102; l. lat. 165. 21 rows of scales between upper and middle and 28 between middle and lower lateral lines.

Silurus asotus, L.

Vernacular name: *Lien yu.*

Macrones longirostris.

Macrones longirostris, Günth. Ann. & Mag. Nat. Hist., Sept. 1873, p. 245.

Vernacular name: *Hui wang yu.*

Macrones Vachellii.

Bagrus (?) *Vachellii*, Richards. Ichth. China and Japan, p. 284.

Silurus calvarius, Basilewsky, Nouv. Mém. Soc. Imp. Nat. Mosc. x. 1855, p. 241, pl. ix. fig. 1.

Pseudobagrus Vachellii, Günth. Fish. v. p. 85.

Vernacular name: *Ko ya tzu yu.*

Formerly I was inclined to refer *S. calvarius*, Basil., to *Macrones fulvidraco*, but that name, I have now no doubt, was intended for the present species.

Cyprinus carpio, L.

Vernacular name: *Li yu.*

Hypophthalmichthys molitrix, C. V.

Vernacular name: *Chiang pan tou yu*.

Opsariichthys Morrisonii, sp. n. (Pl. XIII. fig. A.)

D. 10. A. 10. L. lat. 48. L. transv. 9/5.

Head compressed, deep, its depth being two thirds of its length. The eye is immediately below the upper profile, distant more than two diameters from the angle of the mouth; it is small, one seventh of the length of the head, and two fifths of that of the snout. Interorbital space flat, $2\frac{1}{2}$ times as wide as the orbit. Mouth wide, the maxillary extending to below the middle of the eye. The end of the lower jaw is received in a notch of the upper, and has on each side in front a notch to receive a strong projection of the upper jaw. The third, fourth, and fifth anal rays are prolonged into a lobe which reaches the base of the caudal. Origin of the dorsal opposite to that of the ventral, but only very little nearer to the root of the caudal than to the end of the snout. Caudal deeply forked. The pectoral does not extend to the ventral. The depth of the body and the length of the head are a little more than one fourth of the total length (without caudal). Suborbital ring broad, its width below the orbit being equal to that of the orbit. Silvery.

The specimen is 9 inches long, fully mature, and was caught during the breeding-season, the lower jaw and other parts of the head being beset with small dermal tubercles. The species is allied to *O. bidens*, and bears the Chinese name of *Pai-ku yu*. For comparison the latter species is figured on Pl. XIII. fig. B; it has been described in Ann. & Mag. Nat. Hist., Sept. 1873, p. 249.

Culter erythropterus.

Vernacular name: *Pai yu*.

Culter erythropterus, Basil. Nouv. Mém. Soc. Imp. Nat. Mosc. x. 1855, p. 236, tab. viii. fig. 1; Günth. Fish. vii. p. 328.

Culter ishæformis, Bleek. Nat. Verh. Ak. Wet. xii.; Cyprin. Chin. p. 67, tab. x. fig. 1; Günth. Ann. & Mag. Nat. Hist., Sept. 1889, p. 227.

Culter Sieboldii, Dybowski, Verh. zool.-bot. Ges. Wien, xxii. 1872, p. 214 (is probably the same fish).

Having now had the opportunity of comparing a specimen from Northern China with others from the Yangtsekiang, I have convinced myself of their specific identity. Bleeker's first description in Ned. Tijdschr. Dierk. ii. p. 27, was faulty.

Culter Sieboldii, from the Amur, seems to me to be the same fish.

Coilia nasus, Schleg.

Vernacular name: *Tao yu*.

It may appear doubtful whether Basilewsky's *Osteoglossum prionostoma* should be referred to this species or to *Coilia clupeoides*.

Chatoëssus punctatus, Schleg.

Vernacular name: *Hai chi yu*.

Harpodon nehereus, H. B.

Vernacular name: *Mien tiao yu*.

Anguilla bostoniensis, Les.

Vernacular name: *Shan yu*.

The eel in Dr. Morrison's collection shows the technical characters of the form "*bostoniensis*," although also *Anguilla vulgaris* and *A. mauritanica* have been brought from China. It will always be doubtful to which of these forms Basilewsky's *A. pekinensis* should be referred.

Trygon, sp.

A young specimen, without tail.

Vernacular name: *Yang yu*.

EXPLANATION OF PLATE XIII.

Fig. A. *Opsariichthys Morrisonii*.

Fig. B. — *bidens*.

XLIII.—*Notes on the Physical Aspects and on the Food-Fishes of the Liao Basin, North China.* By W. MORRISON, M.D.

AT the request of Dr. Günther I offer herewith a few notes, supplementary to the preceding paper, on the physical aspects of the Liao basin and on the food-fishes of Newchwang, some of which are not included in the collection made for me by H.M. Consul, Mr. A. Hosie, and described by Dr. Günther.

The chief source of the Liao River is in Mongolia, near the southern termination of the Kinghan range of mountains, in lat. 43° 30' N. and long. 118° E. During its course

through Mongolia it is named the Sira muren (yellow river). The direction is easterly for about 300 miles. Soon after entering Manchuria the course changes from E. to S.S.W., and it is thenceforth named the Liao. Altogether after a course of about 600 miles it enters that portion of the Yellow Sea named the Gulf of Liau-tong, near the treaty port of Newchwang, in lat. $40^{\circ} 57' N.$, long. $121^{\circ} 27' E.$

Near its southward bend it receives from the north the Hen-su River, and soon after the Kai-yuen branch from the north-east.

In the alluvial plain the chief tributary on the left bank is formed by the union of two rivers—the Hun, which flows south-west near Mukden (the Manchurian capital), and the Tai-tzu, which flows west past the city of Liauyang. The river formed by their union, after a very brief course, joins the Liao 60 miles north from Newchwang.

Tributaries, though not so important, are also received from the west.

Northward in lat. 44° a low range forms the watershed between the Liao and Songari. The tributaries which are there in close proximity are the Y-tung, which flows north to the Songari, and the Hen-su, which flows south to the Liao.

From the Gulf to the rise of the Hen-su the basin of the Liao has a length of about 300 miles. In addition, and of nearly equal length, there is the western prolongation along the course of the Sira muren.

Viewing the Sira muren and Liao as one river, the physical conditions admit of a threefold division. The first section of the course is among mountains with intervening valleys, possessing a considerable rainfall. Next there is a portion that flows through steppe country, with small rainfall and few tributaries. The last and chief portion is that which flows through the great alluvial plain, where important tributaries are received and the rainfall is moderate, but subject to occasional variations. The Hun and Tai-tzu tributary rivers, which have been visited by me, are clear rivers flowing over pebbly bottoms.

At Newchwang, 10 miles distant from the sea, the river is $\frac{1}{4}$ mile broad and from 20 to 30 feet deep. The tidal influence extends to about 20 miles above Newchwang. The river is navigable for river cargo-boats for about 200 miles. There is no proper estuary. The river has cut a channel for itself, outward into deep water, amid shallows and sandbanks.

The rocky coast of the peninsula to the east is distant by boat about 12 miles from the river's mouth. There behind

some rocky promontory is situated the fishing village, and fishing junks and boats of various sizes find friendly shelter. Shore fishermen also reside in cottages scattered along the seaboard. Wooden stilts, 4 to 5 feet in height, which when in use are strapped firmly to the leg, are in requisition. By their aid the fishermen can wade in deep water. A large net is pushed along in front; a small hand-net is kept for emptying it, while the fish-basket, supported on floats, is dragged behind.

While on a visit there I have observed that the *Algæ* growing on rocks were scarce and stunted, and the shells of shore-mollusks seemed dwarfed in size. Mud held in suspension must be an important factor in determining the forms of life that find in the river a suitable habitat. Distributed by currents it may also have a modifying influence on the fauna of the adjacent coast. Temperature is also an important factor. For two months in summer the heat is tropical, while during the winter the sea is frozen across for from two to three months.

When the river is in flood the country is under water for long distances. When the waters subside fish can be caught in pools and ditches by waysides.

Fishing to a limited extent is carried on during winter through holes made and kept open in the ice.

In addition to the fishes enumerated in Dr. Günther's paper others, belonging to the genera *Scomber*, *Gadus*, *Clupea*, *Platessa*, and *Solea*, may be found at times in the market at Newchwang.

The genus *Culter*—like the greater number of specimens in the collection—is in common use for food among the Chinese, but does not appear on the table of foreign residents.

Mugil so-iuy is a valuable food-fish. The flesh is a little softer than that of the herring or trout, but the flavour is pleasant, and it is procurable for the greater part of the year.

Harpodon nehereus (the "silver fish" of foreign residents) answers in some measure to "whitebait," and is in frequent request for the foreign table.

Anguilla bostoniensis.—Smoked eel affords a palatable dish.

During winter fish are readily preserved in the frozen condition. This affords facility for transport, but makes it at times difficult to trace the species to their native habitat. The "codfish" (size comparable to that of an average haddock) of foreign residents is caught on the western coast of the peninsula during the early days of December, and, along with oysters of good quality, sent up to the port in the frozen condition. It is not supplied at any other time. Like-

wise during winter the following are imported from the Songari:—

Acipenser mantschuricus ("huang yu").—This fish furnishes "caviare" more suitable to Russian low temperatures and gastric capabilities than to the ordinary resident at treaty ports. The flesh of the sturgeon is very palatable, but unsuitable to persons with weak digestion.

"White Fish" (length 18 inches and upwards) comes to Newchwang from the Songari *via* Mukden, where it is known by foreign residents under that name—probably a translation from the Chinese words "pai yu." This fish is of excellent quality and flavour, approaching in these respects to the famous "Sam lai" imported here from Shanghai, and stated by Richardson (Ichthyol. China, p. 305) to be *Alosa Reevesii* and *A. palasah*.

Salmo, sp.?—The Salmonoid imported in late autumn to Newchwang by steamers from the Amur is probably identical with that found in the lower Songari; it is known to ascend the Songari as far as San-sing near lat. 47° N. In the Hurka, a tributary which joins the Songari at San-sing, travellers describe its capture during the spawning-season in immense numbers. There its name is *Ta-ma-ha*. It forms the staple supply of food, and yields oil and clothing for the Yapi-Ta-tzu, or Fish-skin Tartars. These Salmonoids show a remarkable uniformity in size, the average weight being 10 lbs. There are two large teeth in each jaw. The colour (while spawning) is darker and lacks the silvery lustre of *Salmo salar*. The sides are marked with extensive pink patches.

Salmo, sp.—Möllendorff (Verteb. of Chili, in Journ. N.C.B. Roy. As. Soc. 1877, p. 107) states that he had not been able himself to discover a specimen of Salmonidæ in Chili. A specimen was brought to him, however, by a friend from a locality about 150 miles north of Pekin, where they were stated to exist in abundance, and were procurable up to 1½ feet in length. The specimen was young and not very well preserved, but was that of an undoubted trout. The colour was reddish grey with small black spots. This fish did not agree with any European species, and was believed to come from an affluent of the Luan River. Chinese name 'hua-yu, i. e. spotted fish.

XLIV.—*Notes on the Embryology, Anatomy, and Habits of Yoldia limatula, Say.* By GILMAN A. DREW.*

In this short abstract attention will briefly be called to some points of interest in the development, anatomy, and habits of *Yoldia limatula*, a member of Pelsner's order Protobranchia. A more detailed description will follow at a later time.

EMBRYOLOGY.

The eggs are about .15 millim. in diameter, of a chocolate-brown colour, and very opaque. They are laid free in the water, and are not encumbered by any kind of envelope. The polar bodies are lost soon after they are formed. The first cleavage results in the formation of subequal blastomeres. Subsequent divisions give rise to an epibolic gastrula in which there may be as many as sixty outer ectoderm-cells. Some of the ectoderm-cells wander into the interior, the entoderm-cells divide, and at one side of the resulting cell-mass a narrow tube appears, which opens to the exterior through the blastopore. As it has not been determined whether this tube is ectodermal or endodermal in origin, whether it represents a stomodæum or a primitive gut, it will throughout this description be referred to as the ventral tube.

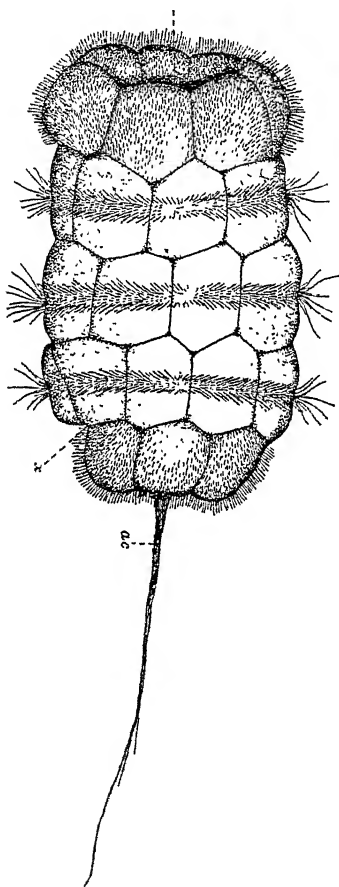
While these changes are taking place about forty-two of the surface ectoderm-cells enlarge, become vacuolated, and acquire cilia. The embryo also elongates (fig. 1), becomes cylindrical, acquires an apical plate which bears a tuft of apical cilia, *ac*, and the outer cells, which will hereafter be referred to as test-cells, arrange themselves in five rows. The blastopore, *bl*, occupies the end of the cylinder opposite the apical plate, and a depression, *x*, appears near the anterior end of what may now be referred to as the ventral side. The two end rows of test-cells are entirely covered with fine cilia, and the three intermediate rows each bear a band of much longer cilia. The embryo now swims in more or less definite lines, rotating the while upon its longitudinal axis. During activity the apical cilia are bunched together into a sort of whip, and always precede the embryo.

Inside the test a new ectoderm is formed, probably from the ectoderm-cells that wander in. At the age of about forty hours a few of these ectoderm-cells elongate and give rise to the shell-gland, which spreads over the dorsal portion of the

* From the 'Johns Hopkins University Circulars,' November 1897, pp. 11-14.

embryo, but never forms a distinct invagination. At most it is only slightly concave when viewed from above, and soon becomes arched outward. These changes are accompanied by the formation of the mid-gut, a term that is not intended

Fig. 1.

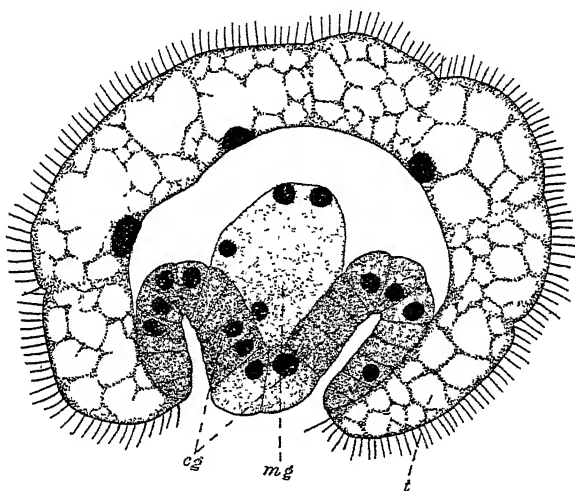


External appearance of an embryo of forty-four hours.
ac, apical cilia; *bl*, blastopore; *x*, ventral depression.

to include the ventral tube, which is of unknown origin. From the beginning it is connected with the ventral tube, formed, as it were, as a continuation of the anterior extremity of the ventral tube.

From a time preceding the formation of the apical plate a few cells of ectodermal origin have occupied an anterior position. These cells extend ventrally to the depression α (fig. 1), and push in between the test-cells. It was apparently from cells connected with this group that the apical plate was formed, and now, at about forty hours, other cells from this same group form two thick-walled pouches, which open to the exterior between the test-cells. These are the rudiments of the cerebral ganglia. Fig. 2 represents a transverse section of an embryo of fifty-eight hours, taken through

Fig. 2.



Transverse section of an embryo of fifty-eight hours, taken through the depression α , fig. 1. *eg*, pouches which form the cerebral ganglia; *mg*, wall of the anterior end of the mid-gut; *t*, test.

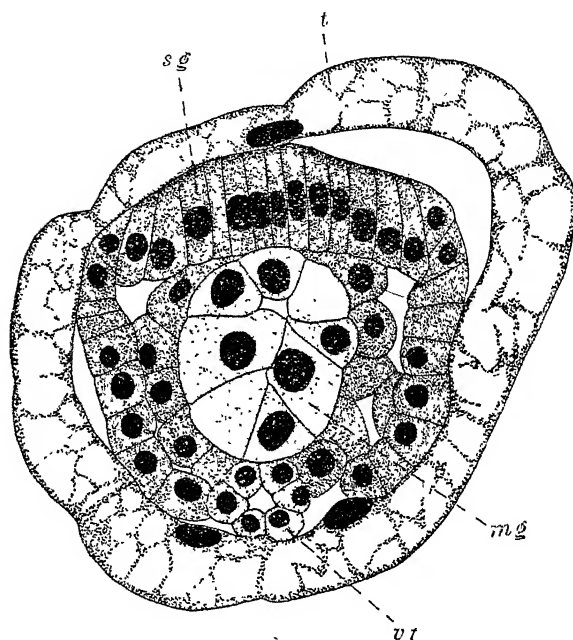
the depression α (fig. 1). The test, *t*, is shown to be composed of large vacuolated cells, the walls between which are no longer very distinct. As this section cuts the anterior row of test-cells, they are uniformly covered with cilia. The rudiments of the cerebral ganglia, *eg*, appear as two thick-walled pouches. The wall of the anterior end of the mid-gut, *mg*, appears in section.

Fig. 3 represents a transverse section of another embryo at a corresponding stage, taken just in front of the second band of cilia. The shell-gland, *sg*, has become arched upward, and is on the verge of protruding laterally to form the

mantle. The mid-gut, *mg*, and the ventral tube, *vt*, are both shown in cross-section.

This stage is of interest in showing the beginnings of the ectodermal thickenings that form the pedal ganglia and the ectodermal invaginations that form the otocysts.

Fig. 3.



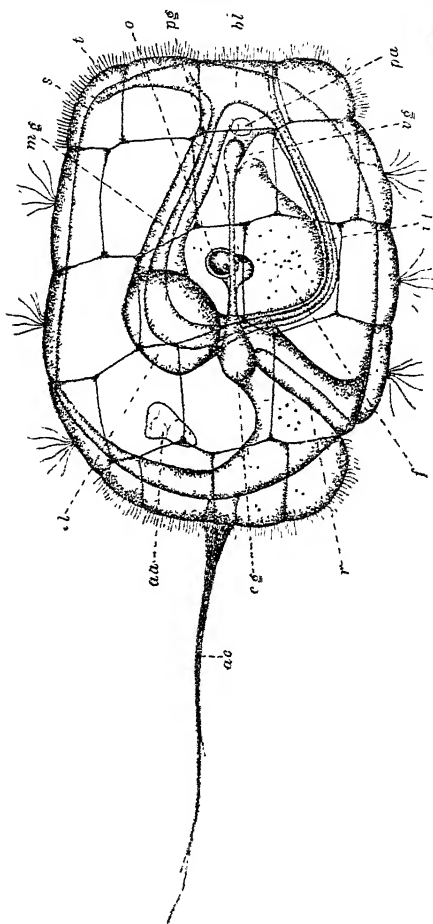
Transverse section of an embryo of fifty-eight hours, taken just in front of the second band of cilia. *mg*, mid-gut; *sg*, shell-gland; *t*, test; *vt*, ventral tube.

As the shell-gland spreads out into the mantle, the embryo becomes slightly compressed laterally, the foot appears, and the visceral ganglia may be distinguished.

Fig. 4 represents a reconstructed embryo of one hundred and five hours. The test-cells, *t*, are now very flat and much thinner than at an earlier stage. The shell, *s*, indicated in outline, is well formed. The anterior adductor muscle, *aa*, occupies a rather isolated position. The posterior adductor muscle, *pa*, has just made its appearance. The foot, *f*, is pretty well formed, and has running over and united to its

tip the ventral tube, *vt*, which opens to the exterior through the blastopore, *bl*, and is continuous with the mid-gut, *mg*.

Fig. 4.



Reconstruction of an embryo of one hundred and five hours; cilia indicated only at the margins. *aa*, anterior adductor muscle; *ac*, apical cilia; *bl*, blastopore; *cg*, cerebral ganglia; *f*, foot; *ll*, left liver-lobe; *mg*, mid-gut; *ot*, otocyst; *pa*, posterior adductor muscle; *pg*, pedal ganglion; *r*, pouch extending from the cerebral ganglia to the exterior; *s*, shell; *t*, test; *vg*, visceral ganglion; *vt*, ventral tube.

The embryo at this stage has acquired an anus, which has broken through into the upper part of the blastopore. The

liver, of which the left lobe, *ll*, is indicated, has made its appearance as evaginations of the mid-gut. The cerebral ganglia, *cg*, pedal ganglia, *pg*, and visceral ganglia, *vg*, are connected by commissures. The cerebral ganglia have been carried some distance from their point of origin, but are still connected with the exterior by the unpaired space, *r*, which has followed them in. The otocysts, *ot*, seem to be completely closed off, and each contains an otolith that stains deeply with hæmatoxylin and a little later plainly shows concentric structure. As the otocysts have never been open to the exterior, development having taken place inside a closed test, the otoliths cannot be foreign particles.

At about the age of one hundred and five hours, or a little later, the embryo stops swimming, settles to the bottom, the cilia shrivel, the test-cells break apart and go to pieces, and the animal is left in its clear white shell free upon the bottom. Beside the test, the casting includes the stalk that extends from the test to the cerebral ganglia, the apical plate and its connexion, and the ventral tube from the blastopore to the position of the definitive mouth. The time occupied by these changes is very brief, only a very few minutes at most.

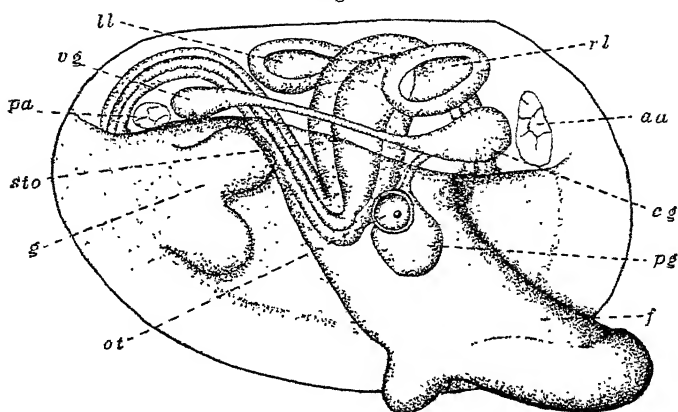
The foot, which at first is capable of only feeble movements, grows rapidly, and is soon very active. It is never moved slowly, but is thrust out with a jerk and withdrawn quite as suddenly. Locomotion is chiefly effected by long and powerful cilia, which are arranged along the sides of the foot, and are very active whenever the foot is thrust out of the shell. The animal is thus enabled to glide over the surface on which it rests, but is unable to rise.

The gill rudiments appear in about one hundred and fifteen hours as thickenings of the posterior portion of the mantle. Each thickening becomes more pronounced, and is soon divided by a constriction into two parts—one dorsal, the other ventral. This constriction deepens, the ventral portion broadens, is carried posteriorly, and in turn becomes divided into two parts. In the meantime the alimentary canal has lengthened, the stomach has enlarged, the left liver-lobe has become larger than the right, and the foot has acquired a "sole," which roughly corresponds in shape and movements with the "sole" of the adult. Locomotion is still materially aided by the long and powerful cilia. Fig. 5 represents a reconstruction of an embryo twelve and a half days old, as seen from the right side, with the right shell-valve and the mantle-lobe removed. The powerful cilia of the foot and gill and the fine cilia that cover the surface of the body and project into the lumen of the alimentary canal have not been

indicated. The lettering will enable the reader to identify the different parts.

The most striking peculiarities in the development of *Yoldia* are connected with the formation and disappearance of the test. So far as is known, *Dondersia* is the only other mollusk whose embryo has a locomotor test. A short account of the embryology of *Dondersia banyulensis*, illustrated by three figures, has been published by Pruvot (7). The fully formed tests of both *Dondersia* and *Yoldia* consist of five rows of cells, all of which bear cilia. The cilia on the third

Fig. 5.



Reconstruction of an embryo of twelve and a half days, seen from the left side, with the left shell-valve and mantle-lobe removed. *aa*, anterior adductor muscle; *cg*, cerebral ganglion; *f*, foot; *g*, gill; *ll*, posterior prolongation of the left liver-lobe; *ot*, otocyst; *pa*, posterior adductor muscle; *pg*, pedal ganglion; *rl*, right liver-lobe; *sto*, stomach; *vg*, visceral ganglion.

row of cells (counting from the anterior) of *Dondersia* and the second, third, and fourth rows of *Yoldia* are long and collected into bands which surround the embryos. The body of the embryo of *Dondersia* protrudes posteriorly during development. No such protrusion takes place with *Yoldia*. Each is provided with an apical plate and apical cilia, and in either case the test is finally cast off.

The young larva of *Dentalium*, as figured and described by Lacaze-Duthiers (4) and Kowalevsky (3), bears a certain resemblance to those of *Dondersia* and *Yoldia*. This is largely due to three or more rows of cells, each of which bears a band of cilia. At this stage these cells form the

greater part of the external surface of the embryo. As the body of the larva elongates posteriorly these cells are crowded forward to form the velum, which, however, does not seem to be cast off.

Through these forms we may, perhaps, trace an homology between the test of *Yoldia* and the velum of other forms. In this connexion it is interesting to notice that in a few forms the velum is known to be cast away. This was observed by Sigerfoos (8) for *Teredo* and by Wilson (9) for *Polygordius*.

The condition presented by the mouth and anus both opening through the blastopore is interesting. It may be that the blastopore offers the only available place for the anus to open, or it may stand in relation to forms on the one hand that have the blastopore persisting as the mouth, and on the other hand to forms that have the position of the blastopore occupied by the anus.

The formation of the cerebral ganglia from the walls of invaginations deserves special mention, inasmuch as it seems to be the first case reported for the Lamellibranchiata.

ANATOMY AND HABITS.

Yoldia limatula lives in soft mud or ooze, in which it moves about by means of its muscular foot, which is so modified that its edges can be turned outward and so form a first-rate anchor. So efficient is the foot in burrowing that a specimen placed upon the surface of the soft mud in which it lives will completely bury itself with two thrusts of the foot. The foot is very sensitive and is moved with wonderful rapidity. In every way it shows itself to be nicely adapted for burrowing. It seems very hard to imagine that it could possibly be used as a creeping-organ.

From the posterior part of each external palp there arises an elongated appendage, known as the palp-appendage, which can be protruded to a distance considerably exceeding the length of the shell. This appendage is folded longitudinally to form a groove that runs from its tip to its point of attachment.

When the animal is feeding the shell is slightly tipped ventrally from the perpendicular, and about two-thirds of its anterior end is buried in the mud. The palp appendages are thrust out of the shell, and one at least bends over and inserts its tip into the mud. The cilia lining its longitudinal groove immediately begin to elevate the mud, which is rich in living organisms. The stream of particles passing along the groove is large enough to be distinguished at a distance of some feet.

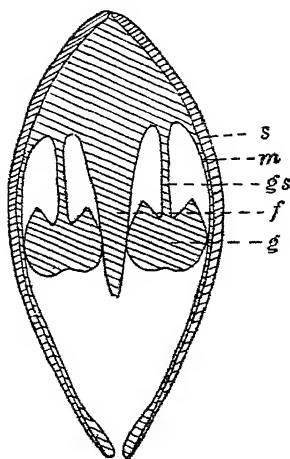
In this way foraminifers, ostracods, and even small lamelli-branches and gastropods, are passed along the groove, between the palps, and finally into the mouth.

Thus we find that Mitsukuri's surmise (5), based on finding sand in the grooves of the palp-appendages of preserved specimens, was right. The palp-appendages are food-collectors.

Experiments were tried to determine if possible the part taken by the gills in collecting food. No definite results were reached, but in no case was Kellogg's observation (2) that the gills are extremely active food-collectors confirmed.

Considering the remarkable activity of the palps in collecting food, such activity for the gills seems rather unnecessary, and it would also seem that the pumping action of the gills, presently to be described, would seriously interfere with their performing such a function.

Fig. 6.



Diagrammatic transverse section of an adult animal, taken just in front of the posterior adductor muscle. *f*, foot; *g*, gills; *gs*, gill suspensory membrane; *m*, mantle; *s*, shell.

It is well known that each pair of gills is suspended from the body-wall by a membrane, but little or no attention has been given the fact that this membrane is muscular. As the gills are composed of wide plates, they are sufficiently broad to span the spaces between the foot and the mantle-lobes (fig. 6), and behind the foot unitedly to span the entire

mantle-chamber. Anteriorly the gills gradually diminish in size and finally disappear. Posteriorly they are attached to the wall and separate the two siphons. The mantle-chamber is thus divided by a movable partition into a ventral chamber, opening through the inhalent siphon, and a dorsal chamber, opening through the exhalent siphon.

In young specimens, in which the brown gills are visible through the shell, the movements of the gills may be observed. They are gradually pressed ventrally, probably by the blood forced into them, the water passing between the gill-plates as they descend. This is followed by a quick contraction of the suspensory membranes (fig. 6, *qs*), accompanied by a vigorous discharge of water through the exhalent siphon as the dorsal chamber diminishes, and a corresponding influx of water through the inhalent siphon as the ventral chamber enlarges. The movements of the siphons accompanying the movements of the gills are very conspicuous, and have been mentioned by Brooks (1). The movements are more or less rhythmic, the time varying with the needs of the animal.

The currents of water are probably primarily for respiratory purposes, but they aid in clearing the mantle-chamber from the dirt that is constantly finding its way in, and more especially from the fæces, which, being so largely composed of sand and mud, would otherwise drop into and soon clog the mantle-chamber. Besides creating currents of water, these movements may aid in causing the exchange of blood.

The inner, pericardial, and outer, mantle-chamber, ends of each excretory organ lie very near each other. Pelsner (6) has described the genital duct as opening into the excretory organ near its pericardial opening. In all the cases that I have examined the genital duct bends ventrally, when almost in contact with the inner end of the excretory organ, meets the end and opens with it. The common opening of the excretory organ and genital duct into the mantle-chamber is elongated antero-posteriorly, and seems to represent a fusion of the two rather than an opening of one duct into the other.

No distinct separation into cerebral and pleural ganglia has been observed.

The otocystic canals have not been traced to the exterior, but they are distinctly visible near the otocysts. Their meaning is not clear to me, as the otocysts seem to be entirely closed off at an early age.

In closing, attention will be called to two sensitive areas on each mantle-margin. These lie opposite the extremities of shell-stripes that run from the beaks to the ventral margin, one anterior, the other posterior. The anterior area is in the

form of an elliptical projection, and the posterior area is a flat expansion. Both, especially the anterior projection, are quite sensitive to mechanical stimulation. They are both entirely distinct from the organ of special sense described by Brooks (1). Their special functions remain to be determined.

My thanks are due to Dr. W. K. Brooks, who has directed this work, and I wish publicly to acknowledge my indebtedness to my wife, who has materially aided me in securing, tending, and preserving specimens.

Zoological Laboratory, Johns Hopkins University,
Baltimore, May 1, 1897.

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XLV.—*On some new Mammals from the Neighbourhood of Mount Sahama, Bolivia.* By OLDFIELD THOMAS.

THE British Museum has purchased from Mr. Gustav Garlepp a small series of mammals obtained by him at Esperanza, a “tambo” in the neighbourhood of Mount Sahama, Bolivia, while collecting birds for Count von Berlepsch. The specimens prove to be of considerable interest, as there are among them examples of no less than five new species, one of these representing a new genus.

Mr. Garlepp informs me that “the mammals were all taken at an altitude of 4000 metres in the ‘Puna’ region—that is to say, on the high plateau between the Coast

Cordillera and the main Eastern Cordillera—a region which is without trees and is partly covered with low bushes and partly with short grass. In this steppe-like country, and not on broken or rocky ground, all the mammals were collected. Mount Sahama itself, distant some 50 kilometres from the place where the collection was made, is one of the highest peaks of the Coast Cordillera, attaining an altitude of about 7000 metres.”

Besides the new species, examples of *Canis azaræ*, *Ottonomys opimus*, *Lagidium peruanum*, and *Cavia boliviensis* occur in the collection.

Conepatus rex, sp. n.

Size comparatively large. Fur very long and thick, 75 to 80 millim. long on the back. Hairs of neck and anterior back definitely reversed forwards, from a pair of prominent hair-whorls just behind the shoulders to a transverse ridge between the ears, formed by the meeting of the opposed hairs. White of back forming two broad bands, extending from the hair-ridge between the ears backwards on to the rump, but not reaching the tail; in front of the hair-whorls these bands are separated by a narrow black band about half an inch in breadth, which disappears at the whorls, where the two bands coalesce. Behind the whorls the two bands rapidly separate to a distance from each other of about 3 or 4 inches. Tail very long and bushy, much longer than in most of the South-American forms, and uniformly bushy throughout, the hairs from 80 to 120 millim. in length; in colour it is nearly wholly black, there being only a few scattered white hairs on its terminal third. Posterior half of soles thickly hairy.

Dimensions of the type (an old female), taken on the skin, and all merely approximate:—

Head and body 430 millim.*; tail, without hairs 270, with hairs 340; hind foot, without claws 66, with claws 73.

Skull: basal length 67·5; greatest zygomatic breadth 45; greatest mastoid breadth 41·5; interorbital breadth 22·5; intertemporal breadth 19·5; palate length from gnathion 31·5. The teeth are too much worn down to be measured or described.

Type B.M. no. 98. 3. 16. 4; original number 1752. Killed 3rd June, 1897.

This exceedingly handsome skunk is quite unlike any *Conepatus* that I can find recorded. Perhaps the nearest to

* Mr. Garlepp gives 680 millim. as the total length in the flesh.

it is the specimen from "Tropical America" described in 1865 by Gray as "*Conepatus nasutus*, var. 4. *Lichtensteini*"*, but this differs by its smaller size, narrower white dorsal lines, white tail, naked soles, and other details. Somewhat similar specimens to the latter come from Costa Rica.

Phyllotis (?) *Garleppii*, sp. n.

General appearance very like that of one of the North-American "Grasshopper Mice" (*Onychomys*), an appearance chiefly due to the short tail. Fur close and thick, not particularly long for an inhabitant of such altitudes; hairs of back about 12 millim. in length. General colour above greyish buff, finely lined with black, becoming clear buff along the sides. Face rather paler, rump rather stronger buff, but no special contrasts present. Eyes without darker rings. Ears smaller than in other *Phyllotes*, their colour not unlike that of the back, except that the anterior part of the outer surface is rather blacker. Hairs of under surface slaty basally, snowy white terminally, the line of demarcation on sides sharply marked; on the chest the hairs are snowy white to their roots. Hands and feet pure white above; soles hairy for their posterior two thirds. Tail extremely short, not twice the length of the hind foot; closely haired, pure white above and below throughout.

Skull with a very convex frontal profile, the muzzle being markedly bent downwards; nasals long, hiding the incisors from above; zygomata starting very strongly and abruptly outwards, and then turned back almost at a right angle, front edge of their anterior root much slanted and running up to a very high level on the skull, so that the forehead does not project above the upper anterior zygoma-root. Supraorbital edges square, not ridged. Palatal foramina long and well open, reaching backward to the middle of *m*.¹.

Incisors more thrown forward than usual, very slender, their narrow anterior faces pale yellow above and below.

Dimensions of the type (an adult male) measured in skin:—

Head and body 123 † millim.; tail 33; hind foot (wet) 25; ear (wet) 18.

Skull: greatest breadth 17·8; nasals 13·4 × 4; interorbital breadth 3·7; palate length from henselion 14·2; diastema 3·7; palatal foramina 7·2 × 2·5; length of upper molar series 5·1; lower jaw, condyle to incisor-tip 21.

* P. Z. S. 1865, p. 147; Cat. Carn. B. M. p. 135 (1839).

† "Total length 165 millim." (*G. Garlepp*).

Type B.M. no. 98. 3. 16. 5; original number 1740. Killed May 20, 1897.

It is with great doubt that I place this remarkable mouse in the genus *Phyllotis*, as its short tail and hairy feet give it a very different appearance to that of *Ph. Darwini*, the typical species of that group. *Ph. boliviensis*, however, seems so to connect the two forms that, until further material is obtained, Mr. Garlepp's mouse may be provisionally referred to *Phyllotis*.

CHINCHILLULA, gen. nov.

Form approximately that of the short-tailed species of *Phyllotis*. Ears very large. Fur excessively long and soft. Palms and soles naked, except just under the heel, with 5-6 pads; pollex with a rather elongated nail.

Skull very much as in *Phyllotis*, but the molar teeth enormously enlarged and very high-crowned, their greatest breadth equal to the space between the anterior pair. In pattern they are simpler than in *Phyllotis*, the posterior lamina of *m.*¹ simply transverse and not tending to be constricted into two loops; *m.*² and *m.*³ without anterior supplementary cusps and the general pattern simpler, posterior lamina of *m.*³ much narrower than the anterior. Lower molars similarly modified; the posterior supplementary hooks absent, and the last molar, instead of being more or less sigmoid, consisting of two simple laminæ connected mesially, the posterior much smaller than the anterior.

Chinchillula sahamæ, sp. n.

Size about as in *Phyllotis Darwini*, but general form appearing stouter, mainly on account of the length of the fur. Pelage excessively long, soft and silky, very like that of a Chinchilla both in colour and texture, the underfur about 18 or 19 millim. long on the back, and mixed with a few longer hairs, which attain to upwards of 25 millim. General colour above cinereous grey, washed with blackish; the hairs of the back slaty for four-fifths their length, then pale greyish white, and finally tipped with black. The projecting ends of the longer hairs are black, except on the rump, where they are white. Eyes faintly black-ringed. Ears large, rounded, their visible surfaces, when folded, black; a small white patch at the base of their outer margin. Outer side of hips with a whitish projection running up from the belly-colour into that of the back, succeeded behind by a blacker area on the back of the hams, and this again succeeded by a white

area round the base of the tail. Belly-hairs snowy white terminally, slaty basally. Upper surface of hands and feet well-haired, white. Tail less than half as long as the head and body, well-haired and pencilled, though not to be called bushy, uniformly white throughout.

Skull (in a rather immature specimen) rounded, not unlike in general outline that of *Phyllotis Darwini*, though broader in proportion to its length. Nasals barely reaching forward far enough to hide the incisors; behind they just surpass the premaxillary processes. Supraorbital edges square (probably sharply so in old age), not beaded or ridged. Interparietal large. Anterior edge of zygoma-root little projecting, evenly slanting forwards. Anterior palatine foramina well open, their edges sharply ridged, their posterior ends level with the anterior lamina of m^1 . Hinder edge of palate level with the centre of m^3 , V-shaped instead of transverse, but this may be due to youth. Bullæ rather larger than in *Phyllotis*.

Teeth.—Incisors narrow, smooth in front, pale yellowish above and below. Molars as described above; their extreme hypsodontism may be gauged by the fact that the vertical height of the first outer groove on m^1 is no less than 3 millim. At its broadest point m^1 is 2.5 millim. in breadth.

Dimensions of the type (a slightly immature male), measured in skin:—

Head and body 122* millim.; tail 59; hind foot, without claws (wet) 26.5, with claws 28; ear 23.

Skull: basal length (c.) 25; basilar length (c.) 24; greatest breadth 16.5; nasals, length 10.7; interorbital breadth 4.8; interparietal 3.7×12 ; palate length from hensenion 14; diastema 8; palatine foramina 6.3×2.6 ; length of upper molar series (on alveoli) 7.2.

Type B.M. no. 98.3.16.6; original number 1777. Killed June 25, 1897.

Akodon Berlepschi, sp. n.

Size and general proportions about as in *A. mollis*, Thos. Fur thick and close, about 7–9 millim. long on the back. General colour above dark cinereous grey, blacker on the centre of the back, clearer grey along the sides; no tendency to fulvous, rufous, or olive tones. The hairs of the back are an unusually dark blackish slaty, with a subterminal band of white, succeeded by black tips; there are also a considerable number of longer black hairs intermixed with the shorter ones. Face like back, no darker markings round eyes.

* Mr. Garlepp records the total length, including tail, as 185 millim.

Ears of medium length, thickly hairy, blackish grey terminally, more whitish grey basally, a lighter greyish patch present behind their posterior bases. Under surface strongly contrasted white, the bases of the hairs slaty, their tips snowy white. Hands and feet wholly white above. Anterior claws rather more elongate than in the allied forms. Tail about equal in length to the body without the head, well-haired, prominently bicolor, black above and white below for its whole length, except that the tip below is also blackish.

Skull almost precisely similar to that of *A. mollis*; interorbital region broad, its edges square, not ridged. Interparietal quite minute. Palatine foramina reaching back beyond the middle of *m*.¹.

Dimensions of the type, measured in skin :—

Head and body * 104 millim.; tail 75; hind foot (wet) 20; ear (wet) 13.

Skull: back of interparietal to front of nasals 24.2; greatest breadth 13.3; nasals 13.6 × 3.2; interorbital breadth 5; palate length from henselion 11; diastema 6.9; palatal foramina 6 × 2.1; length of upper molar series 4.1.

Type B.M. no. 98. 3. 16. 7; original number 1695. Killed 28th April, 1897.

While as regards the skull this mouse can scarcely be distinguished from *A. mollis*, its colour is entirely different both from that and every other known *Akodon*.

I have named this species in honour of Count von Berlepsch, the eminent ornithologist, by whose assistance Mr. Garlepp was enabled to make his explorations and through whose courtesy the British Museum has been allowed to acquire the mammals he collected.

Cavia niata, sp. n.

Size small, about as in *C. australis*. Fur of medium length, the hairs 15–18 millim. long on the back. General colour a peculiar pale yellowish buff, quite unlike that of any other Cavy. Face, cheeks, hairs on and at base of ears more whitish buff. Whole of under surface and anal area white, with a slight buffy tinge, not sharply defined on the sides; bases of hairs pale slaty. Upper surface of hands and feet also buffy white.

Skull very peculiarly shortened and rounded, in exaggeration of the characteristics of that of *C. australis*. Upper profile very strongly convex, the muzzle bent down to an unusual angle with the basicranial axis. Nasals short and

* "Total length 175 millim." (*G. G.*).

broad, evenly broadening backwards, and then abruptly truncated, not narrowing to a median point posteriorly, their hinder margin convex backwards; premaxillary processes very narrow and slender. Zygomata strongly and evenly bowed outwards, the outlines of the two, continued across the muzzle, forming together three-fourths of a circle. Palatine foramina long, as in *C. australis*, but markedly narrower. Posterior palatal margin rounded, not angular, level with the hinder lamina of *m.*³.

Incisors slender, narrow, the upper ones more thrown forwards than in other species, their front surface white. Posterior talon of *m.*³ much less developed than in *C. australis*.

Dimensions of the type (an adult female):—

Head and body (*vide* Garlepp) 190 millim.; hind foot (wet) 34; ear (wet) 13.

Skull: basal length 36·6; basilar length from henselion 33·5; greatest breadth 29·5; nasals 15×9·1; interorbital breadth 11; palate length from henselion 18·5; diastema 9·3; palatal foramina 5·5×2·1; length of upper molar series (crowns) 10·2.

Type B.M. no. 98. 3. 16. 20; original number 1716. Killed May 8, 1897.

The only known species to which this curious little Cavy is even distantly allied is *C. australis*, but that differs markedly from it both in cranial and external characters. *C. mœnas*, described in the following paper, is, on the other hand, closely allied to *C. australis* and equally distant from *C. niata*.

XLVI.—*Descriptions of Two new Argentine Rodents.*

By OLDFIELD THOMAS.

(L.)

THE British Museum owes to the kindness of Dr. F. P. Moreno, of the La Plata Museum, the skin of a Cavy from Rioja, obtained by him during the same expedition on which he discovered the *Eligmodontia Moreni* described by me in 1896*. In working out the Cavies collected by Mr. Garlepp and referred to in the preceding paper the Rioja one also proves to be new, and may be described as follows:—

* Ann. & Mag. Nat. Hist. (6) xviii. p. 307 (1896).

Cavia mænas, sp. n.

Nearly allied to *C. australis*, but larger. General colour dull buffy fawn, the hairs pale slaty basally, with subterminal buffy bands and black tips. Eyes with well-marked whitish rings. Hairs on inner side of ear and on the patch behind its posterior base whitish. Under surface buffy white, not sharply defined, the hairs slaty grey basally. Uppersides of hands and feet dull whitish, tending towards fawn mesially.

Skull with a much longer and more parallel-sided muzzle than *C. australis*, the nasals practically as broad in front as behind; interorbital region flat, little ridged, its edges more nearly parallel than in *C. australis*. Lacrymals as in that species. Palatal foramina very long, uniting with the incisive fissures, not of the characteristic triangular shape of those of *C. australis*.

Upper incisors vertical, not thrown forward; white in front. Talon of *m.*³ long, about equal in extent to the second lamina of that tooth.

Dimensions of the type, in skin:—

Head and body (evidently stretched) 265 millim.; hind foot, without claws 41, with claws 45.

Skull: tip of nasals to bregma 35·5; greatest breadth 30; nasals 18·7 × 6·5; interorbital breadth 11·1; palate length from henselion 22·6; diastema 12·5; palatal foramina 10 × 3; length of upper molar series 12·2; lower jaw, back of condyle to incisor-tip 37.

Hab. Chilecito, Rioja, 1200 metres.

Type B.M. no. 96. 10. 7. 12. Collected and presented by Dr. F. P. Moreno, of the La Plata Museum.

This species is evidently the North-Argentine representative of *C. australis*, to which species alone it is nearly allied and from which it may be distinguished by its more buffy colour, longer nasals, more vertical incisors, and longer palatal foramina. Besides the type, the Museum possesses an example in spirit from Mendoza of what appears (allowing for the cranial variation usual in the group) to be the same form, while a third example—a skin—was said to have come from "Chili"; but it seems probable that this statement is erroneous.

(II.)

When in Argentina in the early part of 1896 I was given by Dr. C. Spegazzini, of the La Plata Institute of Agronomy, four specimens in the flesh of a Tuco-tuco, which he had

obtained at "Las Talas" *, a district along the lower part of the Santiago River, near Ensenada, the port of La Plata. This animal, when describing *Ctenomys Perrensi*, I referred † with some doubt to Dr. Nehring's *Ct. minutus*, originally from Mundo Novo, Rio Grande do Sul. Thanks to the kindness of Dr. Nehring, I now possess a careful drawing of the largest of the three skulls he founded that species upon, and am therefore able to make a comparison between *Ct. minutus* and the La Plata animal. From the drawing it appears to me evident that Dr. Nehring's specimens were immature—so much so, indeed, that I doubt if the full-grown animal is any smaller than the Uruguayan *Ct. torquatus*, Licht. In any case, however, the Ensenada Tuco-tuco, of which an old male barely exceeds in size the immature *Ct. minutus*, besides differing in other characters, must be considered as a distinct species.

Ctenomys talarum, sp. n.

Size very small; form, as judged by skull, more slender than usual. General colour above very dark, the usual buffy or clay-coloured subterminal bands on the hairs being much hidden and obscured by their unusually broad black tipping, the whole of the back being as dark as the very darkest patches on the spine of *Ct. Perrensi*. Centre of face nearly or quite black. Cheeks like back; a small but well-marked whitish patch just at the lower edge of the ear. Under surface pale, almost exactly "cream-buff" of Ridgway, the chest very faintly darker; white axillary and inguinal patches very small. Sparse hairs of hands and feet whitish buff. Tail blackish brown above, pale buffy below.

Skull much lighter and more slender than in any other species known to me. Muzzle narrow, parallel sided. Nasals broad, rapidly narrowing backward. Interorbital region narrow, the postorbital processes delicate. Brain-case low and flattened. Interparietal small, broader than long. Bullæ narrow.

Incisors less broad than in the allied species, their faces as usual deep orange-yellow above and below.

Dimensions of the type (an adult male), taken by myself in the flesh:—

Head and body 172 millim.; tail 55; hind foot, without claws, 30.

Skull: basal length 40.3; basilar length 38; zygomatic

* So called from the Tala trees (*Celtis tala*) which grow in the locality.

† Ann. & Mag. Nat. Hist. (6) xviii. p. 312 (1896).

breadth 26·2; nasals $15 \times 7\cdot2$; interorbital breadth 8·5; breadth across postorbital processes 9·5; least breadth across brain-case 16·2; greatest posterior breadth on auditory meatus 24·7; palate length from henselion 20·7; diastema 13; length of upper molar series 8·6; greatest diameter of anterior tooth (p.) 3·5.

Hab. "Las Talas," Ensenada, La Plata.

Type collected June 24, 1896. Original number 169.

This little species may be readily distinguished from any hitherto described by its small size, dark coloration, and slender skull.

XLVII.—On *Peripatus novæ-britanniæ*, *sp. n.*

By ARTHUR WILLEY, D.Sc.

LAST year I obtained thirteen specimens of a species of *Peripatus* in New Britain, of which eleven were females and the remaining two males. The following brief diagnosis will suffice to show that this species constitutes a new (Melanesian) type of *Peripatus*, conforming neither to the type of the Neotropical, nor of the Australasian, nor of the Ethiopian species.

I. *Colour*.—In the living animal the colour consists generally of large and small brownish-yellow spots dotted upon a black background. On the dorsal surface the larger spots are arranged segmentally, one row on each side above the bases of the legs and another row on each side of the median line. On the ventral surface there is a median row of brown spots surrounding the ventral organs. The black ground-colour developed a bluish tinge after preservation in 5-per-cent. formol, and the ventral surface was then seen to be rather less deeply pigmented than the dorsal surface.

II. *Female*.

1. *Length* of largest specimen 54·75 millim., with maximum width of 5 millim.
2. *Twenty-four* pairs of claw-bearing appendages.
- *3. *Legs* provided with three spinous pads; the apertures of the enlarged segmental organs of the fourth and fifth legs placed in the centre of the third or proximal pad; a similarly placed aperture sometimes occurs on the sixth leg.
- *4. *Feet* with a primary papilla on the anterior and

Nos. 3 to 5 apply to both sexes.

posterior margins, and a dorsal papilla, which is sometimes median-dorsal and sometimes more or less closely approximated to the anterior papilla.

- *5. *Outer blade of jaw without* accessory minor tooth.
- 6. *Generative aperture* placed immediately *behind* the last pair of legs.
- 7. *Receptacula seminis* present. r
- 8. *Embryos in all stages of development* may occur in the uteri of one individual.

III. *Male* (peculiar features) :—

- 1. *Length* 15 millim.
- 2. *Twenty-two* pairs of claw-bearing appendages.
- 3. *Generative aperture* placed at the end of a relatively long, backwardly directed, conical papilla, immediately behind the last pair of legs.

- IV. 1. The identification of the sex of the individuals with 22 pairs of legs was confirmed by dissection.
- 2. The probability of the constancy of the difference in the number of the legs of males and females was strengthened by the examination of the older embryos found in two of the females.
- 3. I hope shortly to publish an illustrated account of this interesting species.

XLVIII.—*On Two Subspecies of the Arctic Fox* (*Canis lagopus*). By G. E. H. BARRETT-HAMILTON and J. L. BONHOTE.

A COMPARISON of a set of Arctic Fox skulls brought back by Barrett-Hamilton from Kamtchatka and the Commander Islands with the series already in the British Museum collection has revealed the fact that the skulls of those foxes which inhabit the continent of Europe and Asia (and the Commander Islands) may be distinguished from those of Spitzbergen by their larger size and lesser proportionate breadth. It is therefore necessary, according to the custom now in vogue among naturalists, to distinguish the two subspecies by name, and we propose that the fox from Spitzbergen should be known as *Canis lagopus spitzbergenensis*, subsp. n., while the foxes of the mainland should be designated as *Canis lagopus typicus*.

The material at present available seems to establish the

* Nos. 3 to 5 apply to both sexes.

apparent identity of the Spitzbergen foxes with those of Iceland, Novaya Zemlya, and Greenland, since the measurements of skulls in the museums of Dundee and Cambridge, for the use of which we are indebted to the kindness of Professor D'Arcy W. Thompson, C.B., and of Mr. S. F. Harmer, show that the Iceland and some of the Greenland foxes belong also to a small race, which we are unable to distinguish from that which inhabits Spitzbergen. In Greenland it is interesting to note that both forms occur; and although the localities which accompany some of the skulls from that country are not as exact as we could wish, there is evidence to show that the ranges of the smaller and larger races meet somewhere in the neighbourhood of Davis Straits, and hence it seems possible that the foxes of the American mainland belong to a large race like that of the mainland of the Old World. This supposition is partly borne out by the presence in the British Museum collection of a large female skull from the Aleutian Islands (no. 91. 12. 18. 3). As, however, it is well known that Arctic foxes have been frequently turned down on the islands of the Aleutian chain, we do not think it advisable to give too much importance to this specimen.

At all events we have no specimens from the American mainland with which to compare our Old-World series, and hence it is only possible, in the present state of our knowledge, to distinguish two races, one of which—the larger—is found all round the Arctic portions of the Eurasian continent and on the Commander Islands, and probably also on the corresponding portions of North America, while the smaller race is confined to Spitzbergen, Iceland, and Greenland, meeting the larger race at Davis Straits.

We are not in a position to give any external differences whereby the two races may be distinguished, as the British Museum does not possess a series of skins of the Arctic Fox. It is probable, however, that such external differences exist.

The average total length of the series of skulls of the larger form which we have been able to examine is 134 millim., and of the smaller form only 126 millim., for males, the corresponding measurements of the skulls of female animals being 124 and 118 millim. respectively; so that the dimensions of males from Spitzbergen overlap those of females of the larger race.

The largest male skull of *C. lagopus typicus* (e coll. G. E. H. B.-H. no. 17) reaches a length of 140 millim., and the smallest (e coll. G. E. H. B.-H. no. 20) 130·5 millim.; both are from Kamtchatka. The largest Spitzbergen male which

we have examined (B. M. coll. no. 96. 9. 23. 5) reaches a total length of only 127.5 millim. The females exhibit the same characters, but are smaller. In conclusion, it may be noted that we have examined specimens from Kamtchatka, the Aleutian and Commander Islands, Lapland, Norway, Spitzbergen, Iceland, and Greenland.

Dimensions of the type of *C. lagopus spitzbergenensis*, a female collected in Spitzbergen by Dr. J. W. Gregory (B. M. coll. no. 96. 9. 23. 3):—Basal length 109 millim.; greatest length 118.5; greatest breadth 66; length of palate 56; length of nasals 38; length of lower jaw 86.

XLIX.—*A Review of the Species of the Genus Hebomoia, a Group of Pierine Butterflies.* By ARTHUR G. BUTLER, Ph.D., F.L.S., F.Z.S., &c.

THIS genus, of which the Museum collection now contains all the known forms, consists chiefly of a series of fairly well-defined geographical modifications, mostly inhabiting different islands, and consequently exhibiting a degree of constancy in their often slight distinctive characters which gives them some title to be regarded as diverse species. Several of these species were named by Wallace in 1863, in a paper published by him in the 'Journal of Entomology'; but in his "Revision of Oriental Pierinæ," published four years later in the 'Transactions of the Entomological Society,' he ignored all but two of them, not even quoting the names which he had given, in his synonymy.

It has been generally considered that one species of *Hebomoia* is distributed over the whole of India, Burma, China, and Ceylon; but a study of our present fine series has convinced me that this is not correct, inasmuch as the forms of Northern and Southern India differ quite as much as typical *H. glaucippe* does from its representative forms in some of the islands.

The seasonal forms of *Hebomoia* do not seem to be very strongly defined even on the Continent, and probably in the insular species they are unrepresented.

I. *H. glaucippe* group.

Wings above milky white, rarely tinted towards the borders with brimstone-yellow: primaries of males with a broad triangular orange apical patch, broadly bordered externally and

sometimes internally with black-brown, and crossed by a more or less prominent series of sagittate blackish spots: secondaries frequently with black spots, especially towards apex; the apex of the primaries in the female black-brown, crossed by a more or less broad oblique orange belt, followed by a transverse series of orange spots.

1. *Hebomoia glaucippe*.

Papilio glaucippe, Linnæus, Mus. Lud. Ulr. p. 240 (1764).

Papilio callirrhoe, Fabricius, Syst. Ent. p. 473 (1775).

North-eastern India*, Burmah southwards to Malacca, China.

The dry form differs from the wet in its inferior size, more falcate primaries, and the often browner and always less strongly reticulated character of apex of primaries and the secondaries on the under surface.

2. *Hebomoia australis*, sp. n.

The Southern representative of *H. glaucippe*. It differs in the feeble indication or entire absence of the black inner edging to the orange apical patch of the males and in the reduction of this edging in the females. In size it corresponds with the more widely distributed form.

Southern India from Mysore south-eastwards to Ceylon.

Our series of *H. glaucippe* consists of forty selected examples in addition to four in the Hewitson collection. Of *H. australis* we have fifteen examples.

3. *Hebomoia javanensis*.

Iphias javanensis, Wallace, Journ. Entom. ii. p. 3 (1863).

Java. Six examples. B. M.

A small representative of *H. glaucippe* in which the under-surface colouring of the secondaries and apex of primaries is slightly more tinted with sienna.

4. *Hebomoia lombockiana*, sp. n.

Intermediate in character between *H. glaucippe* and *H. timoriensis*; the outer border and transverse spotting of the apical patch of the primaries being similar to that of the former, but the form of the inner edge of this patch irregularly zigzag as in the latter, and with a sulphur-yellow border,

* We have one example labelled "Malabar," but this locality is vague and perhaps incorrect.

its inferior extremity edged with blackish in the male and its entire inner edging blackish in the female: the under-surface colouring is somewhat more golden than in either species.

Size similar to that of *H. timoriensis*.

Lombok (*Wallace*). One pair. B. M.

This has as much claim to a distinct name as any of the other insular representatives of *H. glaucippe*.

5. *Hebomoia timoriensis*.

Iphias timoriensis, Wallace, Journ. Entom. ii. p. 3 (1863).

Timor (*Wallace*). Four specimens B. M.; one coll. Hewitson.

Costal margin of primaries rather longer than in the preceding, border of orange patch narrower and transverse spots very small; no blackish inner edging, but a well-marked diffused sulphur-yellow border: secondaries of male without marginal spots: reticulation of under surface rather denser than in *H. glaucippe*.

6. *Hebomoia philippensis*.

Iphias philippensis, Wallace, Journ. Entom. ii. p. 3 (1863).

Philippine Islands. Fifteen specimens B. M.; one coll. Hewitson.

Size of the preceding, the inner edging of the orange patch similarly formed, but sometimes partly margined with blackish (more often without this margin in both sexes), the yellow diffused border of the male usually extending far back into the wing, the secondaries often washed with sulphur-yellow on the outer border, the whole surface of the female often suffused with sulphur-yellow; the outer border and spots on the primaries much as in *H. glaucippe*, the marginal spots towards apex of secondaries often present. Under surface like that of *H. glaucippe*.

7. *Hebomoia celebensis*.

Iphias celebensis, Wallace, Journ. Entom. ii. p. 3 (1863).

Celebes.

Very like typical *H. glaucippe*, but with longer costal margin to the primaries and the blackish inner edging of the orange apical patch nearly or quite as wide as the outer border; the black spots towards apex of secondaries squamose, but extending for some distance up the nervures. We have six examples.

Some lepidopterists will probably regard the preceding seven forms as mere local variations of *H. glaucippe*. In any case it is far more convenient that they should have distinctive names; and as Wallace set the example, I have thought it best to complete his work by naming the two forms which he overlooked.

II. *H. borneensis* group.

Very like the preceding group, but the male with the apex of the primaries black, crossed by a broad belt of orange, traversed by the usual black spots, that of the female black, crossed by a narrow oblique milk-white or orange bar, followed by three or four spots of the same colour parallel to outer margin; markings below more dusky brown than in the species of group I.

8. *Hebomoia borneensis*.

Iphias borneensis, Wallace, Journ. Entom. ii. p. 3 (1863).

Borneo. Eighteen examples B. M.; three coll. Hewitson.

9. *Hebomoia sulphurea*.

Iphias sulphurea, Wallace, Journ. Entom. ii. p. 5 (1863).

Iphias Felderi, Vollenhoven, Monog. Pier. p. 53, pl. vi. figs. 2, 3 (1865).

Batchian and Gilolo. Three males (ex coll. Godm. and Salv.), B. M.; ♂ ♀, coll. Hewitson.

Differs from *H. borneensis* in its superior size, sulphur-yellow colouring, and the orange instead of white bar across the apical patch in the female; ground-colour of secondaries and apical area of primaries on under surface bright golden ochraceous, but with dark brown markings.

III. *H. Vossii* group.

Primaries more distinctly triangular; wings above more or less gamboge-yellow; orange apical patch on primaries occupying nearly half the wing-surface.

10. *Hebomoia Roepstorffi*.

Hebomoia Roepstorffi, Wood-Mason, Journ. Asiat. Soc. Beng. xlix. 2, pp. 134, 150, and 235 (1880).

Andamans. Ten specimens B. M.; two coll. Hewitson.

Five of our examples, including two females, were received from the Godman and Salvin collection.

In this species the basal area of the wings is milk-white.

11. *Hebomoia Vossii*.

Iphias Vossii, Maitland, Tijd. Ent. ii. p. 25 (1859); Vollenhoven, Monog. Pier. p. 55, pl. vi. fig. 4 (1865).

Nias. Three males. B. M.

One of our specimens was received from the Godman and Salvin collection. The species is larger than *H. Roepstorffi*, and the ground-colour of the wings above is entirely gamboge-yellow; the ground-colour below is also yellower (less orange).

IV. *H. leucippe* group.

The orange apical patch extends nearly to the base of the discoidal cell of the primaries.

12. *Hebomoia leucogynia*.

Iphias leucogynia, Wallace, Journ. Entom. ii. p. 4, pl. i. figs. 1, 2 (1863).

♂ ♀, Bourou. Three specimens B. M.; two coll. Hewitson.

The internal area of the primaries and entire secondaries above pale sulphur-yellow; the female blackish and whiter above.

13. *Hebomoia leucippe*.

Papilio leucippe, Cramer, Pap. Exot. i. pl. xxxvi. A-C (1775).

Amboina and Ceram. Seven examples in B. M.; four in coll. Hewitson. Three of our specimens were received from the Godman and Salvin collection.

In this species the primaries are orange excepting at the base, which is yellow dusted with grey; the orange area on the female also is about as extensive as in the male of the preceding species; the secondaries are gamboge-yellow, and the latter, as well as the apical area of the primaries, deep cadmium-yellow on the under surface.

I consider *Ptychopteryx Lucasii*, Grand., to represent *Hebomoia* in Madagascar; both in general aspect and structure it is nearly related to the latter.

L.—*Descriptions of some new Species of Butterflies of the Subfamily Pierinæ.* By ARTHUR G. BUTLER, Ph.D.

THE following species in the Museum collection have hitherto remained unnamed:—

Mylothris bogotana, sp. n.

♀. Allied to *M. malenka*, but differing in the pattern of the primaries, the tawny discoidal and somewhat shorter submedian longitudinal streaks becoming sulphur-yellow at the extremities; beyond and well separated from these are two isolated yellow spots placed obliquely, and beyond the cell three elongated spots of the same colour in an oblique subapical series instead of the oblique quadrifid belt of *M. malenka*.

Expanse of wings 75 millim.

Santa Fé de Bogotá (*Stevens*). B. M.

This is not likely to be a variety of the Venezuelan species, as it is believed that in this group the variations of the female are not very great.

Elodina Walkeri, sp. n.

Allied to *E. perditā*, the male with shorter primaries; the apical patch always as broad as in *E. perditā* ♀, and not incised or dentated below the third median branch: apex of primaries below silvery, with three increasing blackish subapical spots in an oblique series; a sulphur-yellow subcostal streak from base, and in the discoidal cell a saffron-yellow suffusion: secondaries silvery white; a blackish dot at end of cell and four or five blackish discal spots in an obtusely angular series between the nervures.

Expanse of wings 38 millim.

Port Darwin (*J. J. Walker*). B. M.

We have six examples, of which five were collected by Mr. Walker; the sixth is one of our oldest specimens, the registered locality for which was simply "New Holland."

Elodina baudiniana, sp. n.

Also allied to *E. perditā*, but distinctly smaller and very uniform in pattern: above pearly snow-white; primaries with costal margin smoky greyish, basal half of costal border flesh-

tinted, a rather narrow blackish apical patch, widest on costa (where it occupies about the external two-fifths of the margin) and tapering to extremity of second median branch, its inner edge dentated; a small and slightly browner spot at extremity of first median branch: below like the preceding species, but the black spots often very indistinct.

Expanse of wings 33-38 millim.

Baudin Island (*J. J. Walker*). B. M.

Of this species we have fourteen examples.

Terias Chamberlaini, sp. n.

♂. Bright gamboge-yellow; costal margin of primaries very delicately black, excepting towards the base; costa sprinkled with black scales to end of discoidal cell; extreme base of cell and of submedian vein marked by short black dashes; outer border narrowly dark brown, commencing at about two-fifths of the length from apex and tapering to extremity of first median branch, its inner edge zigzag from the third median branch hindwards: secondaries with a conspicuous pure white glandular patch towards base above the subcostal vein; veins terminating in very minute black dots followed by orange spots at the base of the fringe: body normal. Under surface gamboge-yellow, sparsely and very finely irrorated with brown atoms; a well-defined black spot at the end of each discoidal cell; fine black dots followed by orange angular markings terminating the veins, the orange markings uniting and covering the fringe towards apex of primaries; a pure white glandular patch between median and submedian veins towards base of primaries; a very indistinct **W**-shaped series of squamose brown spots crossing disk of secondaries.

Expanse of wings 30 millim.

Bahamas (*Neville Chamberlain*). B. M.

We only possess one male of this pretty little species. If Felder's statement was correct that his *T. smilacina* nearly approached *T. smilax* both in pattern and structure, this would be the second New-World species of the *T. læta* group; but an examination of Felder's description clearly shows that his species did not possess the glandular patches which characterize the *T. læta* group, and therefore was "wirklich nicht zunächst verwandt" to *T. smilax* (as he ought to have said).

LI.—*The Boa-Constrictors of British Guiana.*

By J. J. QUELCH, B.Sc. Lond., C.M.Z.S.*

THESE reptiles possess a somewhat special interest for residents in tropical America, seeing that they are at once a pest and a pest-destroyer in the general economy of nature. The term boa-constrictor in common parlance is applied to any snake that secures its prey by enwrapping and crushing it to death, and it is more frequently used perhaps to denote the great pythons of Asia and Africa than the constricting snakes of tropical America, to one species of which—the great land-boá—in a strict system of nomenclature the name rightly belongs. The Boas are thus typically the constrictors of the New World, though they are not confined to it.

Locally the word Camoodie is synonymous with boa-constrictor, and the various species are denoted by such terms as Water-Camoodie, Land-Camoodie, Tree-Camoodie, &c. Generally, however, the water species is referred to particularly as Camoodie, this being the commonest, or, at any rate, that one which is found most frequently, close to the haunts of man; and as it is also the largest, it has come to figure in the public mind as the typical boa-constrictor, in place of its land congener, to which the name belongs.

This group of snakes will readily be recognized here by two very simple characters. The jaws are long and carry each a series of more or less curved and elongated teeth, and the top of the head is covered with small scales of much the same size as those over the body, and not with the larger shields or plates met with in the harmless snakes.

Of all the species the water-boá, which is known technically as *Eunectes murinus*, will be most easily recognized. Its markings and colour are nearly the same in all individuals and at all ages. Above, it is of a glossy brownish black, with a double row of large oval black marks arranged transversely; below, it is mottled or streaked with black and yellowish white; while along each side there is a series of yellow patches surrounded by a black border.

During life the tints are vivid enough, but when the snake is preserved and the skin taken from the body and dried the colours become dull. The skins, however, are in great request for slippers, belts, pouches, and other similar useful or ornamental objects.

* From 'Timehri: the Journal of the Royal Agricultural and Commercial Society of British Guiana,' December 1897, pp. 294-313.

In size this water-boas seems to exceed all other snakes, and it would appear to be more deserving of the ancient name Anaconda than the Eastern forms to which it was first applied. In fact, it may be said that the name is almost limited nowadays to this tropical American species. The length is known to reach quite 37 feet, but it is said that much larger specimens have been taken. On this point, however, it is hardly safe to express an opinion, since unless definite measurements are made, the estimate of size can be of little value.

A case in point, which would suggest caution in accepting the great lengths ascribed to certain animals, may be quoted from the writer's experience as regards the large Black Alligator locally known as Caiman (*Alligator niger*). The length of this form is given by various travellers in the colony, as, for instance, by both Brown and Schomburgk, as from 20 to 25 feet, Waterton even recording 30 feet; but there is no statement of actual measurement. In the writer's experience the largest forms of this species, taken in the very districts referred to by the forementioned travellers, hardly exceeded 14 feet, though when seen in the water they appeared to be considerably larger. A similar example may be found in the great Arapaima fish (*Arapaima gigas*), which is recorded as from 16 to 18 feet in length, while in reality they hardly attain to more than half that size. Actual measurement is requisite in all such cases.

Skins of the water-boas of from 18 to 25 feet in length are frequently obtained, and in the sheltered swamps and along the creeks in the recesses of the forests it may well be that considerably larger animals would be met with. The following experience along the higher Essequibo River tends to support this. In 1894, while passing by a wide outgrowth of closely matted grass from the swampy bank, the boat disturbed an enormous snake, of which the head, neck, and part of the body were clearly seen at a distance of certainly not more than 5 feet. It was noticeable that the head was considerably more than twice as large as that of one of about 20 feet, and this seems to indicate a snake of very large proportions. The unfortunate part of the matter is that snakes of very great size are most likely to be seen in places where it is out of the question to secure them, as it happened in this particular case.

The body of the water-boas is thick in proportion to its length and cylindrical, owing to the strongly developed dorsal muscles from which they derive their great strength. The males, as a rule, are more elongated, and the females thicker towards the end of the body. In this species, as in the other

constrictors, rudiments of hind limbs are found in the form of claws, one on each side of the vent.

These snakes are aquatic, and frequent especially the grassy and sheltered banks in the still reaches of the streams and the wide open water-savannahs. They are widely distributed in all such places over the colony, and are abundant in all the coast districts, more especially in the sheltered waterways close to settlements in the country where poultry is reared. Small specimens up to about 10 feet in length are very frequently caught in such shallow waters, and larger specimens are met with occasionally lying on the grass or tree-stumps by the waterside, or in the act of constricting or swallowing their prey, when they seem, as a rule, altogether disinclined to move, except so far as the contortion of their body for swallowing is concerned.

It is mentioned, on apparently good evidence, that after having swallowed an animal of large size these creatures lie torpid, and are incapable of escaping if disturbed; but to the writer's knowledge no such case has ever been met with in the colony, and it may be doubted whether snakes that were big enough to take in large animals would be afterwards incapable of movement, the more especially that they are little likely to be far away from the moist bank of some waterway.

From the habitat of these reptiles it is not difficult to see that they are well situated for securing their food. From the abundance of creatures that slake their thirst by the waterside, the boas are able to secure all that they need, and they certainly make good use of their opportunities, for when caught they are always well-nourished and fat. Rodents and birds seem to be favourite articles of diet, not only with this species, but with the generality, if not all, of the constricting snakes.

The part which these and kindred reptiles play in maintaining the balance of nature in a group of such remarkable fecundity as the rodents must be therefore of considerable importance to man in the tropics, the more so that the greater number of rodents are among the most serious depredators on cultivation in general.

It must be stated, however, that the range of food of the boas includes a great variety of other animals, such as the great Salempenta or Teguxin lizards and the alligators, besides the smaller mammals generally, and even the small wood-deer and the peccary. The securing of prey such as the mammals or birds is ordinarily an operation of short duration, since the highly organized animal, being once en-

wrapped, succumbs rapidly under the enormous pressure of the folds about its body. It is not often therefore that an observer comes upon the field during the process, except when poultry has been seized close to a dwelling and their cries have attracted the attention of the inmates.

In the case of the alligators it is far otherwise, and the process is always a long one, taking on the character of a combat, except where the snake is disproportionately large. In one case observed the contest certainly extended over two days; and it would seem that, if the snake once succeeds in infolding the alligator in its coils in an advantageous position, the latter must succumb, the result being only a matter of time depending on their relative size.

In all the cases observed the contests took place in the grass-covered swamp or marsh by the riverside, the alligator struggling fiercely with head, legs, and tail, turning about, heaving and wriggling, in a vain endeavour to cast off the boa. It is remarkable that, even when the alligator is of a size such that it might by wriggling reach the deeper water, it seems to avoid it, perhaps from the recognition that in the water, where they would both sink to the bottom, its chances of holding out under the pressure of the snake's folds would be lessened.

On land the continuance of the struggle depends on the crushing power of the boa and the resistance of the alligator, dependent on its size, to suffocation—a process that in these mixed-blooded creatures is only effected with considerable difficulty. Possibly cases may occur where a small boa attempts the impossible, and has eventually to abandon it; but in those that have been under observation the sizes have been such that, while by means of the head, tail, and toes the alligators have been able to toss and wriggle about to a greater or less extent, they were evidently under stress of partial suffocation. For long intervals they would remain perfectly still, perhaps from collapse, or with the expectation that the boas might consider them dead and proceed to unfold them; and then again they would struggle furiously, but equally to no effect.

It is a curious thing that under such circumstances a boa will allow of quite close approach without its attempting to escape or attack if interfered with, and, in fact, the same thing takes place where poultry has been seized and is still in the coils. Disturbance only causes the snake to bind its folds tighter about its prey, as if to prevent its escape, and the reptile can be easily killed—the only compensation in the case of the poultry.

In isolated country settlements where there are quiet water-ways with grassy or bushy banks, the water-boas become a serious nuisance, and cause considerable loss of poultry; and if there happen to be no open spaces, except the dams along the waterside, where the birds are constantly liable to be seized, the keeping of poultry may be quite an impossibility.

These snakes, and in fact the boas generally, thrive well in confinement in the tropics, and if they be kept regularly supplied with water and food they can be handled with impunity at almost any time except during sloughing, when they are apt to be irritable. The water should be sufficient to allow them to immerse themselves entirely. Their growth is by no means slow, a small specimen of less than 4 feet, fed on a diet of rats—of which they are very fond—having reached a length of nearly 10 feet, with proportionate thickness, in about six years.

Occasionally a specimen refuses to take food, and it is surprising for how long a time they are able to exist without feeding, and with but little apparent decrease in size, if any. A specimen kept in a narrow-meshed wire cage in the Museum some years back refused to eat for nineteen months, though it would lie in the water for long intervals; and it seemed at the end of the time to be about as plump as it had been before. Here there was no chance of food being obtained surreptitiously, for the small meshes prevented even a mouse from penetrating inside, and the cage was always under lock and key. Cases of even longer intervals are mentioned as having occurred, but it does not appear that the element of chance feeding was eliminated.

With but two exceptions, in an experience of ten years with several dozens of boas of different species, living food (rats) had always to be given to them; and if this seems a cruel proceeding at first sight, one has only to be reminded that it is about the quickest way of destroying the rats—certainly quicker than drowning them oneself or allowing one's dogs to kill them. The sentimental picture of these creatures trembling with fear under the dreadful fascination of the snakes is but a figment of the imagination. After an experience of many years with a very large number of South-American snakes—poisonous, constricting, and harmless—in relation to living animals—mammals, birds, and other creatures—both in confinement and in open nature, the writer knows of no single fact, nor has come in contact with any observer who can produce any fact, supporting the so-called fascination of animals by snakes. That certain animals may become absolutely paralyzed by fear and incapable of movement at

the sight of a snake's approach is in no case different from the corresponding manifestation of profound fear and collapse on the part of many animals in the presence of extreme danger.

In the case of rats, at any rate, there is not only no sign of any such fear; but they even appear to be more than callous, often attacking and badly biting the snakes if the latter be not hungry, and rendering their removal necessary.

The instances of the two snakes—one a land-boia and the other a water-boia—naturally eating dead animals placed in their cages appear to be quite exceptional, for in other specimens such consumption was only brought about by strategy.

Properly fed and taken care of the water-boia and the land-boia also become extremely quiet and gentle—perhaps, more truly, sluggish—in their movements; and a large specimen of the former, over 20 feet in length, manifested in confinement not the slightest inclination, nor made the slightest attempt, to attack when disturbed, or even when quietly handled. These reptiles are nocturnal in their habits, and when they have the chance seek out dark corners in which to shelter themselves from the light.

When these snakes have become accustomed to a special diet, such as rats, for instance, they seem at times to neglect, even when they are in want of food, other creatures that at first they would have seized upon at once. Thus a large *Salempenta* or *Teguexin* lizard has remained for years in a cage with a water-boia, unmolested, even when the latter has been hungry, and has taken four large rats in succession.

It is a common belief that the boas lubricate their prey before swallowing it. There is really not the slightest foundation for the belief. After the object is dead the snake usually passes its head along or about the body, perhaps to get some idea of the size, but more likely to find the situation of the head, at which part it almost invariably starts to swallow. At this stage there is no saliva on the object; but if, after it is partly swallowed, it has to be rejected on account of too great size, that part of the body which had been in the snake's mouth and throat will be found to be abundantly covered with the saliva poured out during the process of swallowing. In confinement, at any rate, it not unfrequently happens that objects are thus disgorged after being nearly taken down; and it would seem to be due to their being too large, the snakes attempting, through hunger, to prey upon what ordinarily, in nature, would be left alone. The salivation therefore is not the preliminary to swallowing, but the result of it.

The operation of swallowing, which in all snakes is very considerably prolonged, becomes slightly modified in the constrictors owing to the use of the folds of the body in holding the prey, so that they are enabled to push their jaws more easily over it. As in these forms there is generally a greater disproportion between their size and that of the objects swallowed than in other kinds, this hand-like action of the coils of the body becomes of importance.

Their anterior teeth, too, are stronger and more recurved than in other non-venomous snakes, and are directly of use in securing a firm hold of their prey, and thus in allowing the coils of the body to be thrown with certainty and lightning-like rapidity around the object ere any act of defence can take place. Animals with strong and sharp teeth, such as the peccary and the capybara, would make but short work of the slender neck of the snakes were they not rendered perfectly helpless by the enwrapping coils at the very instant of seizure. Thus secured, any movement or struggle on the part of the prey is only met by a tighter clasping of the coils of the snake, nor are they relaxed until all breathing has ceased, the cessation of the respiratory and circulatory movements being easily detected under the tight clasp. Even after the death of the object the tightening of the coils about it can, by artifice, be at once brought about by the slightest disturbance of the body, even at the very time of uncoiling preliminary to swallowing.

There is a natural dread of these great water-serpents among all native people; but attacks on man by them would seem to be of very rare occurrence, and only one instance has ever come directly to my knowledge. In this case a boy washing rice in a calabash by the waterside of one of the large creeks was seized by the hand by a medium-sized snake, and it would perhaps have terminated fatally but that the boy's father, who was chopping wood close by with a cutlass, at once despatched the reptile. From the circumstances of the case it is very likely that the attack was accidental. In the characteristically dark-coloured water of the creek it is hardly possible that the boy could have been seen by the snake. The probability is that the sound made by the calabash in the water was mistaken for that of some animal drinking, and the attack made accordingly. This seems more likely still from the fact that there was not the immediate coiling around the boy so characteristic of the attack of these creatures, and it is probable that if the boy had been able to keep still and allow of the withdrawal of the long curved teeth, the snake would have sunk again from sight.

The above explanation may seem a fanciful one, but it is hardly possible that, under the abundant opportunities for the favourable attack on man by these water-boas under local conditions, there should not be many cases known if man were not naturally exempted. The fear of being seized by these reptiles, which deters so many timid people from bathing in the creeks and rivers, is no doubt natural enough, even if such seizure may only happen by mistake; but the chances of danger are so infinitesimal, that they are hardly worth regarding.

Unlike the other boas, but like water-snakes and vipers generally, the anaconda is ovo-viviparous. The eggs are retained in the body until the young are fully developed and able to look after themselves. It seems to be generally thought that the young are hatched out in the body of the parent, and crawl forth themselves; but to judge from what has been observed in other ovo-viviparous snakes, this is not really the case. The egg-membranes are complete and unbroken at birth, and the young break through after extrusion. This was certainly the case in three separate instances observed by the writer—two in the rattlesnake, and one in the closely-allied labarria—in each of which more than twenty young ones were thus brought forth. No doubt at the time when the young are sufficiently developed and are ready for birth their wriggling movements induce their extrusion, but the eggs are strictly not hatched till afterwards; and the young can be seen closely coiled inside the transparent membranes until they disrupt them and crawl about.

It may possibly be the case at times that the adults are placed under conditions not suitable for the bringing forth of the young, and that the latter are then retained until they do actually crawl out; but in the light of the three instances above quoted, this can hardly be regarded as strictly natural. That unfavourable conditions do modify the breeding-habits of snakes is, of course, well known, and a case in point may be given from the egg-laying Aboma (*Epicrates*). A specimen which was brought to the Museum some years ago in a closely nailed box was observed at the time to be laying, a few eggs being found in a corner of the box, of which two are still preserved in spirit. The snake was placed in a large wire cage—open to light on all sides—together with a set of reptiles, which included four land- and water-boas, a Teguxin lizard, and an iguana. Some six months afterwards the Aboma was noticed to have brought forth several young ones, which were quite strong and healthy. Whether it was due to the change from the dark box to the exposed cage, or to

the presence of the other occupants, there was no doubt but that the snake had retained the eggs until the young were born, and thus departed from its normal habits. This case was reported in this journal at the time ('Timehri,' 1890, p. 370).

The sense of hearing in the anaconda appears to be much more acute^f than either sight or smell. On frequent occasions when rats have been placed in close proximity to the cage not until there was a squeak from them did the snakes begin to move about from one part of the cage to another, as though seeking them. And even when the rats have been placed inside the cage, the snakes have often seemed unable to detect their position unless they have come actually in contact with them. The slightest touch, however, is generally sufficient, not simply for the grasping of the prey by the teeth, but for a rapid coiling of the body, independently, at whatever part the touch may take place. In this latter way Teguxin lizards have sometimes been grasped while moving about (after having been in the same cage for months or years), being mistaken, by contact, for the rats whose squeak had been heard.

It would appear that this acuteness of hearing, as compared with sight, has been brought about by the conditions of life in the water, in which sound would play a very large part in notifying the approach or presence of animals. In the land- and tree-boas, as in snakes generally, the sense of sight is much more acute.

Sight no doubt, even in the anaconda, must be of great importance, since the recollection or remembrance of surroundings would presumably depend on this faculty. A noteworthy example of this may be given in the case of a small specimen of about 8 feet, which, when placed on the Museum floor while its cage was being cleaned, after a time found out and occupied a dark recess—where it was entirely hidden from observation—some distance away, and reached by a circuitous route between the exhibition cases on the floor. More or less time was occupied in finding or reaching the shelter at first, but after a little while the snake invariably made for this place as soon as it was taken out of its exposed cage, and it was always found coiled up in the furthest corner from the light. This was the regular procedure for more than two years, until the cage was moved away into another room. But the most striking feature in the matter is that now, four months after the transference, it is still able to remember the shelter and the way to it from its former position.

Before leaving the subject of the anaconda, it is perhaps worthy of mention that, among many of the common people, there seems to be a belief in the efficacy of the oil obtained from its fat for the treatment of rheumatic and such-like pains, just as there is also in the case of the fat of the electric eel. The shocks from living electric eels are equally believed in by the East-Indian immigrants as curative of such pains.

Very different in appearance from the water-boas is the common land-boas or land-camoodie (*Boa constrictor*). The body is crossed by a series of purplish or reddish-brown irregular or biconcave saddles, connected at the sides and enclosing between them lighter oval or irregular patches, which are usually emarginate in front and behind. Along the sides, arranged transversely, there are elongated or oval purplish patches with lighter centres. The head, too, is much more angular and wedge-shaped, and the scales on top are extremely small and fine.

The general colouring is very variable in this species, whether the individuals be young or old, being at times very dark and intense, and at others quite pale, independent of the brightness and iridescence which always accompanies exuviation. These are the snakes usually taken for performances in menageries and circuses; but it may be doubted whether they are as suitable for the purpose as the water-boas, which, when regularly fed and supplied with water, are altogether more quiet and sluggish.

The largest specimen of this snake taken in the colony to my knowledge measured just over 14 feet; but much larger are said to occur, a length given by one bushman being 26 feet. As the latter specimen, however, was not secured, the apparent size may well have been considerably larger than the actual. Snakes of from 8 to 12 feet are not of common occurrence, but they are occasionally met with. Smaller specimens are more common.

It is somewhat curious that this is the only species which in confinement has ever, to the writer's knowledge, directly attacked other snakes. Accidental cases of the swallowing of one boa by another, as recently happened in the Zoological Gardens of London, are well known to be due to the fact of two snakes attempting to swallow the same object. Such an attempt will very frequently be witnessed among young snakes in general when they have not been fed for some time, and, in fact, almost invariably happens where several specimens are kept together. In the cases referred to, however, the attack was direct. In one, as reported in this journal ('Timehri,' 1887, p. 133), a young boa of 3 feet in

length attacked a large yellow-tail (*Spilotes corais*) of 8 feet and attempted to constrict it, but was eventually defeated and swallowed by the yellow-tail. In another, also narrated in this journal ('Timehri,' 1890, p. 371), young specimens of another boa—the Aboma (*Epicrates*)—were attacked and swallowed. In these instances there was no attempt at swallowing the same object, there being no food in the cage. That the two occurrences were unusual would certainly seem to be the case, however, for other land-boas have frequently been kept with other snakes without any such result.

In this, as well as in other species, the chief differences in habits from those of the anaconda arise from the difference in their habitat. Though the land-boas are frequently found by the waterside, they are seldom, if ever, actually in the water. They secure their prey on land or among the branches of trees, and are as truly arboreal as terrestrial. The hollow trunks of trees, or the sheltered corners between their buttresses, are favourite places of resort; but while seeking their prey these snakes take up more advantageous positions, such as on the low bushy growths or decayed stumps by the banks of the creeks and large rivers. Though they are at times encountered in open daylight, they are chiefly nocturnal, as, in fact, is the case with the group of snakes as a whole, and they are much less frequently met with, therefore, than the general reader would suppose. A fertile imagination no doubt pictures the tropical forests teeming with snakes and other noxious forms, but the reality is far otherwise.

The Aloma or Ringed Boa (*Epicrates cenchris*) has already been referred to. It will readily be recognized by the bright ruddy-brown colour and the series of large, thin, black irregular rings along the back. The sides are marked with dark blotches having lighter areas within. The neck, as in the water-boas, is but slightly thinner than the head, which is thus not distinctly wedge-shaped as in the preceding species, and the scales along the lips are slightly depressed, forming shallow pits.

The vividness of the iridescent tints of this snake in sunlight, more especially when it has just cast its skin, is altogether indescribable, and in the path of sunlight the curving body presents a continuous series of rainbow-tinted gleams. Out of direct sunlight it is quite sombre, giving no indication of remarkable brilliance, and it would be difficult to imagine that any such change could take place.

The habits of this species are practically the same as those of the common land-boas. The size to which it attains, however, appears to be much less, a length of 12 feet being quite

exceptional. They are found much more frequently in the forest districts than in the open lands.

The three remaining boas—species of *Corallus*—are very sharply marked off from the preceding forms by the deep labial pits, which are distinguishable at a glance. The most striking of the three is the green tree-boa (*C. caninum*), which, as in the case of young anacondas, frequents the low bushy growths by the riverside, on which, owing to their colour, it is very difficult to detect them.

The prevailing green colour of the back is varied by a series of white mosaic mottlings arranged transverse to the body, giving to the species a very characteristic appearance. In young specimens, at any rate, the colour seems to be very variable, the green often giving place to bright red, the white mosaic being the same. In the writer's experience no small green specimens have ever been met with in the colony, while young red ones are fairly common. On the other hand, no large red individuals have ever been seen, only the green ones. In preserved specimens, in which the tints have been more or less lost, the red and green examples are almost indistinguishable; but while the red colour is quickly destroyed and the specimen becomes quite pale, the green lasts quite brightly for a very long time, more especially in spirits. In life, however, the difference in colour is most remarkable.

Throughout the colony generally this form is often confounded with the green labarria, the enlarged anterior maxillary teeth being mistaken by the ignorant for poisonfangs. The structural differences, however, are very great, while the very noticeable white markings along the back will at once distinguish this non-venomous species from the Crotaline form.

Among the Carib tribes this snake is known by the name *Wy-o-pomoi*. It is termed by them a "bad" snake, and possibly this refers to the severe gashes which it can inflict with its long teeth.

The two remaining species of *Corallus* very closely resemble each other in their general form. They are elongated and slender, much more so than the other boas, and the neck is sharply constricted, giving a triangular shape to the head. The body is marked by alternating series of transversely elongated dark brown or purplish blotches, often enclosing paler spaces; and on each side of the head, behind the eye, is an oblique dark brown streak.

In the commoner species (*C. hortulanum*) the ground-colour is a pale brownish grey, and the head is marked by a

dark streak in the middle and by two at the sides, one passing along each eye; while the blotches along the body are sub-rhomboidal and more or less clearly defined from each other.

In the other species (*C. Cookii*) the ground-colour is much more yellowish, the head is more irregularly mottled or marbled, and the blotches on the body are much more variable, being less distinctly defined and separated. Size for size, too, the scales are less numerous than in the former species.

In their general colouring both these snakes are very much like the venomous labarria, and, in fact, are often mistaken for it by colonists generally, the elongated anterior teeth being confounded with true poison-fangs.

Time after time the commoner species has been brought to the Museum under the name of the venomous Crotaline snakes, even the native Caribs being deceived by their appearance.

They are both terrestrial and arboreal, and are most frequently met with on the low stumps or the fallen trunks of trees close to the riverside. In their movements they are the most rapid of all the boas, and they seem to be much less sluggish than their congeners. The commoner species has frequently been kept in the Museum cages, but, without exception, they have remained wild and untamed, if one may use the expression—in marked contrast to the other boas, which, under ordinary conditions, can be handled with impunity.

LII.—*On the Arachnida taken in the Transvaal and in Nyasaland by Mr. W. L. Distant and Dr. Percy Rendall.*
By R. I. POCKOCK.

Order SCORPIONES.

Family Scorpionidæ.

Opisthophthalmus glabrifrons, Peters.

Opisthophthalmus glabrifrons, Peters, Mon. Berl. Ak. 1861, p. 514

Loc. Pretoria (*W. L. Distant*).

Hitherto not known from the Transvaal, but recorded from Mashunaland, Nyasaland, and "Caffraria."

Opisthophthalmus pugnax, Thor.

Opisthophthalmus pugnax, Thor. Act. Soc. Ital. Sci. Nat. xix. p. 232.

Loc. Pretoria (*W. L. Distant*).

This is a more southern species than the foregoing, having been recorded from "Caffraria," Durban, Basutoland, and King William's Town.

Cheloctonus Jonesii, Pocock.

Cheloctonus Jonesii, Pocock, Ann. & Mag. Nat. Hist., Jan^r 1892, p. 44.

Loc. Pretoria (*W. L. Distant*).

The type was obtained in the Murchison range in the Transvaal.

Opisthacanthus asper, Peters.

Opisthacanthus asper, Peters, *op. cit.* p. 513.

Loc. Pretoria (*W. L. Distant*) and Barberton, Transvaal (*Percy Rendall*).

Opisthacanthus rugulosus, Poc.

Opisthacanthus rugulosus, Poc. Ann. & Mag. Nat. Hist. (6) xvii. p. 314.

Loc. Fort Johnston, Nyasaland, and Barberton, Transvaal (*Percy Rendall*).

The original examples from Zomba, Nyasaland.

Opisthacanthus validus, Thor.

Opisthacanthus validus, Thor. *op. cit.* p. 243.

Loc. Pretoria (*W. L. Distant*).

Family Buthidæ.

Archisometrus Burdoi, Sim.

Archisometrus Burdoi, Sim. Bull. Soc. Ent. Belg. p. lviii (1882).

Loc. Fort Johnston, Nyasaland (*Percy Rendall*).

Uroplectes flavoviridis, Peters.

Uroplectes flavoviridis, Peters, *op. cit.* p. 516.

Loc. Fort Johnston, Nyasaland (*Percy Rendall*).

Uroplectes vittatus, Thor.

Uroplectes vittatus, Thor. *op. cit.* p. 121.

Loc. Pretoria (*W. L. Distant*), Barberton, Transvaal (*Percy Rendall*).

Uroplectes triangulifer, Thor.*Uroplectes triangulifer*, Thor. *op. cit.* p. 123.*Loc.* Pretoria (*W. L. Distant*).

Order PEDIPALPI.

Damon annulatipes (Wood).*Damon annulatipes* (Wood), Tr. Am. Phil. Soc. xiii. p. 441 (1869).*Loc.* Barberton (*P. Rendall*).

Common in Natal.

Order SOLIFUGÆ.

Solpuga Darlingii, Poc.*Solpuga Darlingii*, Poc. Ann. & Mag. Nat. Hist. (6) xx. p. 259 (1897).*Loc.* Fort Johnston, Nyasaland (*Percy Rendall*).*Solpuga nigrescens*, Poc.*Solpuga nigrescens*, Poc. Ann. & Mag. Nat. Hist. (6) xvi. p. 88.*Loc.* Fort Johnston and Zomba (*Percy Rendall*).*Solpuga hostilis*, White.*Solpuga hostilis*, White, Methuen's Life in the Wilderness, p. 317, pl. ii. fig. 5.*Loc.* Pretoria (*W. L. Distant*) and Barberton (*Percy Rendall*), both in the Transvaal.? *Solpuga brunnipes* (L. Dufour).? *Solpuga brunnipes* (L. Dufour), Hist. Nat. *Galeodes*, p. 52 (1861).*Loc.* Barberton (*Percy Rendall*).

Order ARANEÆ (SPIDERS).

Family Argiopidæ.

Nephila hymenæa, Gerst.*Nephila hymenæa*, Gerst., Von der Decken's Reisen &c. iii. 2.*Loc.* Pretoria (*W. L. Distant*).

Nephila pilipes, Lucas.

Nephila pilipes, Lucas, Thomson's Arch. Ent. ii. p. 413, pl. xiii. fig. 7 (1859).

Loc. Zomba (*Percy Rendall*).

Cyrtophora citricola (Forsk.).

Loc. Pretoria (*W. L. Distant*).

Argiope nigrovittata, Thor.

Argiope nigrovittata, Thor. Öfv. Vet.-Akad. Förhandl. xvi. p. 300.

Loc. Barberton and Fort Johnston, Nyasaland (*Percy Rendall*).

Cærostris sexcuspidata (Fabr.).

Loc. Durban (*W. L. Distant*).

Cærostris Vinsonii, Thor.

Cærostris Vinsonii, Thor., Eugenies Resa, Arachniden, pp 8-9.

Loc. Barberton (*P. Rendall*).

Described from Caffraria.

According to my identification this species may be distinguished at once from the preceding by the fact that the two spiniform processes on the vulva are widely separated at the base, whereas in *sexcuspidata* they arise close together from a common eminence. One of the specimens of this species has the white head-patches noticed by Mr. O. P. Cambridge in his species *C. albiceps*.

Gasteracantha milvoides, Butl.

Gasteracantha milvoides, Butl. Tr. Ent. Soc. 1873, p. 159, pl. iv. fig. 2.

This form may be regarded provisionally, at all events, as a subspecies of the Madagascar *formosa*, Vins., from which it differs in the greater elongation of the posterior lateral spine.

Dr. Percy Rendall obtained two examples at Zomba (Nyasaland). The type was ticketed vaguely "S. Africa."

Gasteracantha ensifera, Thor.

Gasteracantha ensifera, Thor. Öfv. Vet.-Akad. Förhandl. xvi. p. 302 (1860); Eugenies Resa, Arachn. p. 16 (1868).

Recorded from Caffraria. Mr. Distant brought two specimens from Durban.

Gasteracantha ornata, Thor.*Gasteracantha ornata*, Thor. *opp. cit.*

Recorded from Caffraria. Dr. Percy Rendall obtained the species at Barberton in the Transvaal, and Mr. Guy Marshall has sent several specimens from Salisbury in Mashunaland.

Gasteracantha cicatricosa, C. Koch.

Gasteracantha cicatricosa, C. Koch, Die Arachn. xi. p. 54, fig. 877 (1845).

A single specimen from Barberton (Transvaal). This species is, I think, identical with the form described from Caffraria by the Rev. O. P. Cambridge as *proba* (Proc. Zool. Soc. 1879, p. 291).

Family Eresidæ.

Stegodyphus gregarius, Cambr.

Stegodyphus gregarius, Cambr. Proc. Zool. Soc. 1889, p. 42, pl. ii. figs. 4, 5.

Loc. Barberton (*Percy Rendall*).

Described from Durban.

Family Heteropodidæ.

Palystes Spenceri, Poc.

Palystes Spenceri, Poc. Ann. & Mag. Nat. Hist. (6) xvii. p. 58, pl. viii. fig. 3 (1896).

Loc. Barberton (*Rendall*), Pretoria (*Distant*), and Johannesburg.

Palystes Johnstoni, Poc.

Palystes Johnstoni, Poc. *loc. cit.* p. 57, pl. viii. fig. 1.

Loc. Zomba, Nyasaland (*P. Rendall*).

Family Pisauridæ.

? *Euprosthénops australis*, Simon.

? *Euprosthénops australis*, Simon, Ann. Soc. Ent. Belg. xlii. p. 12 (1898).

Loc. Barberton (*Percy Rendall*).

Several dried male examples referable either to this species or to *E. bayonianus*, Capello.

Family Lycosidæ.

Lycosa transvaalica, Simon.

Lycosa transvaalica, Simon, Ann. Soc. Ent. Belg. xlii. p. 26 (1898).

Loc. Pretoria (*W. L. Distant*).

A single mutilated female, without abdomen, agrees with the description of *transvaalica*, which is recorded from Bechuanaland, Griqualand, and the Transvaal.

Lycosa Spenceri, sp. n. (Figs. 1, 1 a, p. 315.)

Colour.—Carapace fusco-castaneous, ornamented with three bands of fulvous-yellow hairs—one median and one on each side, the space between them darker and traversed by radiating stripes; abdomen fusco-fulvous above, marked with small black spots, and a double row of larger black spots running from the shoulders to the posterior end, the shoulders also marked on each side with a longitudinal yellow band, which stretches backwards over about one third of the upper surface of the abdomen; sides of abdomen paler golden yellow; lower surface entirely black, like the coxæ, sternum, maxillæ, and apex of mandibles; upper part of mandibles with brightish yellow hairs; legs and palpi entirely pale yellowish red, without bands.

Carapace excelling patella and tibia of first or of fourth legs, less than protarsus and tarsus of fourth, greater than those of first. Anterior median eyes nearly twice the diameter of the anterior laterals, the eyes slightly procurved; the medians separated from the horny edge of the clypeus by a space equalling half their diameter; posterior lateral eyes much smaller than posterior medians, the space between them about equal to the diameter of the larger.

Vulva consisting of a chitinous plate marked with a deep semielliptical space open behind, the floor (roof) of the space marked with a median crest, which gradually expands posteriorly and quite at its posterior end gives off a right and left process resembling the head of a hammer (fig. 1).

♂.—Much smaller than female, the abdomen more strongly marked above with three black bands—one on each side passing from the shoulder-spot and a broad one in the middle.

Carapace about equal to patella and tibia of first or fourth leg, about as long as the fourth protarsus.

Palpus as in fig. 1 a.

Length of ♀ (type) 17 millim., of carapace 9, of first leg (from base of femur) 20, of fourth 24.

♂.—Total length 12, of carapace 7, of first leg 20·5, of fourth 24.

Length of largest female example 24 millim.

Loc. Durban (*H. A. Spencer*); Estcourt in Natal, 4000 feet (*G. A. K. Marshall*); Pretoria (*W. L. Distant*).

This species resembles in the colouring of the lower surface and legs the Madagascar form described by Dr. Lenz as *L. melanogastra*. The vulva, however, is very different and the pattern of the dorsal surface distinct*.

Lycosa Darlingii, sp. n. (Figs. 3, 3 a.)

Colour black and grey; carapace with median and marginal greyish-yellow bands, the intervening black area traversed on the thoracic region with indistinct pale radiating stripes; abdomen black above, the median dorsal black area defined on each side by a narrow yellow stripe which passes from the shoulder almost to the anus and posteriorly breaks up into narrow transverse stripes and spots; sides of abdomen narrowly greyish yellow; lower surface entirely black; sternum, coxa, labium, and maxilla also black; mandible ornamented in front with red squamiform hairs; legs black and clothed with greyish-yellow hairs, tibiae of third and fourth pairs black at base and apex.

Carapace longer than patella and tibia and than tarsus and protarsus of first leg, about equal to patella and tibia of fourth, and to protarsus and half the tarsus of the fourth. *Eyes* of the anterior line slightly procurved, subequal, and subequally spaced, the medians separated from the edge of the clypeus by a space about equalling their diameter.

Vulva as in fig. 3.

♂.—Smaller than female, with the pattern more pronounced. Carapace a little shorter than patella and tibia of first leg and shorter than protarsus of fourth.

Palp as in fig. 3 a.

* I subjoin the description of an allied species:—

Lycosa pachana, sp. n. (Fig. 2.)

Resembling *L. Spenceri* in coloration of legs and lower surface, but with the lateral bands of the carapace narrower; a continuous broad median dorsal dark band on the abdomen, extending from the shoulders to the anus and gradually narrowing behind; also in having the eyes of the anterior line practically straight and the vulva formed as in fig. 2.

Length 19 millim., of first leg 21, of fourth 25.

Loc. Karagesi (*Emin Pasha*).

Measurements in millimetres.—♀. Total length 19; carapace 9·5; first leg 23; fourth leg 29.

♂. Total length 14·5; carapace 11; first leg 21·5; fourth leg 27.

Loc. Barberton (*P. Rendall*); Estcourt, Natal, 4000 feet (*G. A. K. Marshall*); Enkeldoorn in Mashunaland (*J. ff. Darling*), type.

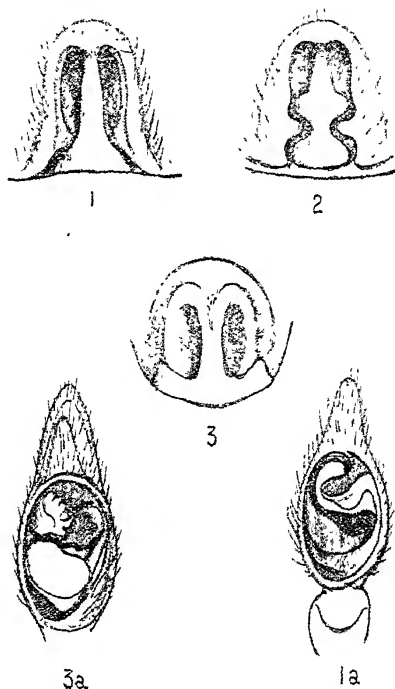


Fig. 1.—*Lycosa Spenceri*. Vulva.

Fig. 1 a.—Ditto. Palpal organ.

Fig. 2.—*Lycosa pachana*. Vulva.

Fig. 3.—*Lycosa Darlingii*. Vulva.

Fig. 3 a.—Ditto. Palpal organ.

This species is related to *L. transvaalica*, but differs in being much blacker in colour, the legs being in no sense "fulvi," as described by Simon. Moreover the median eyes of the anterior line in *transvaalica* are very distinctly larger than the laterals, and not subequal to them. It is also related apparently to *L. capensis*, Simon (Ann. Soc. Ent. Belg. xlii.

p. 26, 1898); but the latter is described as having the lower side of the abdomen "fulvum, crebre albo-roseo pubescens et antice . . . lineolis binis . . . fuscis notatum." The femora, too, are black below at the apex.

Family Theraphosidæ.

Subfam. *HARPACTIRINÆ*.

Harpactira gigas, sp. n.

Colour.—Carapace black, covered with mouse-brown hairs, without a border of pale hairs and without radiating pale lines; for the rest the colouring is practically the same as in *H. tigrina*.

Carapace about one fourth longer than broad, its length considerably exceeding the patella and tibia of the first and fourth legs, longer also than tarsus and protarsus of fourth and than patella, tibia, and tarsus of palp, nearly as long as tibia, protarsus, and tarsus of second and about as long as these segments in the third leg; length from fovea to anterior border excelling fourth protarsus, equal to tarsus and protarsus of second; width about equal to length of patella and tibia of fourth.

Series of bristles below mandibular pad lying almost horizontally; the inferior series close to the oral fringe and consisting of a single row of about a dozen stout bristles, short at the posterior end, long anteriorly where they merge with the bristles of the oral fringe.

Measurements in millimetres.—Total length 40; length of carapace 25, width 20; length of first leg 57, of second 51, of third 46, of fourth 62; patella and tibia of first 22, of fourth 21; protarsus of fourth 14.

Loc. Barberton, Transvaal (*Percy Rendall*).

Differs from *H. tigrina* in having the carapace without a pale border and pale radiating lines; also in the horizontal direction taken up by the row of bristles lying below the pad on the mandible. In this respect it much resembles *H. lineata*, but in the latter the carapace is marked with lines, though less strongly than in *tigrina*, and is about equal to the protarsus and tarsus of the fourth leg, and distinctly less than the tibia, protarsus, and tarsus of the third leg.

Pterinochilus vorax, Pocock.

Pterinochilus vorax, Pocock, Proc. Zool. Soc. 1897, p. 752, pl. xliii. figs. 3, 3a.

The original example of this species was obtained by

Mr. Carson at Fwambo, near Lake Tanganyika. The Museum has recently received from Mr. Hinde an adult male from Machakos (British East Africa). The carapace in this example is unrubbed, and shows a radial arrangement of golden-yellow bands, not traceable in the original example. I have also seen two female examples which I refer to this species—one obtained by Mr. R. Crawshay at Kondiwe and the other by Dr. Percy Rendall at Zomba, both in Nyasaland, British Central Africa.

Some of the differential features of the female are pointed out in the accompanying synopsis of the known species of the genus. Appended, however, are the measurements in millimetres of the female obtained by Mr. Crawshay:—

Total length 37; length of carapace 21, width 16, length from fovea to anterior border 13·5; length of patella, tibia, and tarsus of palp 19; length of first leg 47, of second 41·5, of third 35, of fourth 47; patella and tibia of first 17·8, of fourth 16; protarsus of fourth 11.

The example from Zomba is smaller; its carapace measuring only 16 millim. is equal in length to the patella and tibia of the first leg, but distinctly longer than those of the fourth, which measure barely 15 millim.

Pterinochilus nigrofulvus, sp. n.

♂.—*Colour*. Carapace black, with golden border and bands radiating from the fovea; legs covered with golden and black hairs intermixed; abdomen with golden-yellow or reddish hairs; legs darker below; sternum and coxæ deep chocolate-brown.

Carapace convex, its width about three fourths of its length, length almost equal to patella and tibia of first and fourth legs, equal to protarsus and half the tarsus of fourth, scarcely exceeding patella and tibia of second, slightly less than tarsus and protarsus of third, about equal to patella, tibia, and tarsus of palp; its width much greater than tibia of fourth and equal to protarsus and half the tarsus of first, much less than tibia of first, and about equal to patella and tibia of third leg; ocular tubercle subspherical; clypeus wide, its width about one third the length of the tubercle; distance between lateral eye and edge of clypeus greater than its long diameter.

Legs 4, 1, 2, 3; patella and tibia of fourth and first subequal; patella and tibia of fourth distinctly greater than protarsus and tarsus of first; tibia of first of normal size, not so wide as the femur, its width less than one third of its length, the spur small; protarsus straight, without spine.

Palpal organ with the spine stoutish, blunt at the apex, with a conspicuous crest or keel just above it.

♀.—Colour the same as in the male; clypeus about half as long as the tubercle; carapace at least as long as patella and tibia of first and fourth legs, a little shorter than tarsus and protarsus of fourth, the width equal to the patella and tibia of the second, equal to the fourth protarsus and half the tarsus; length from fovea to anterior margin a little less than fourth protarsus and than patella and tibia of third leg.

Measurements in millimetres.—♂. Total length 19; length of carapace 10, width 8; length of first leg 28·5, of second 26, of third 25, of fourth 32; patella and tibia of first 10·2, of fourth 10; protarsus of fourth 8·8.

♀. Total length 26; length of carapace 11·5, width 9·5; length of first leg 28·5, of second 26·5, of fourth 32; patella and tibia of first 11, of fourth 11, of fourth protarsus 8·5.

Loc. Barberton, Transvaal (*Percy Rendall*).

This species may be recognized as follows from the only other male of the genus known:—

- a. Of small size (carap. 10 mm.); protarsus of first leg straight; carapace not longer than patella, tibia, and tarsus of palp; spine of palpal organ with a strong upstanding crest and a blunt point. *nigrofulvus*, sp. n.
- b. Of large size (carap. 16 mm.); protarsus of first leg basally sinuate; carapace much longer than patella, tibia, and tarsus of palp; spine of palpal organ simple and attenuate *vorax*, Poc.

The females of the three species in which this sex is known may be distinguished as follows:—

- a. Ocular tubercle rounder, not very much wider than long, and separated from the edge of the carapace by a space equalling quite half its length.
 - a¹. Carapace longer than patella and tibia and than tarsus and protarsus of fourth, almost as long as tibia, protarsus, and tarsus of third leg; length from fovea to anterior border greater than fourth protarsus *vorax*, Poc.
 - b¹. Carapace as long as patella and tibia of fourth, shorter than tarsus and protarsus of fourth and than tibia, protarsus, and tarsus of third leg; length from fovea to anterior border less than fourth protarsus *nigrofulvus*, sp. n.
- b. Ocular tubercle more transversely elongate, the clypeus less than half its length (carapace and leg-measurements as under b¹) *murinus*, Poc.

Family Ctenizidæ.

Acanthodon pretoriæ, sp. n.

♂.—*Colour* a uniform earthy red on the carapace and limbs; abdomen greyish black.

Carapace granular, rugose, spinulose, longer than wide, its width equal to the length from the posterior border to the front border of the ocular tubercle; length less than patella and tibia of all the legs, except of the third, longer than patella, tibia, and tarsus of the palp, a little longer than the fourth protarsus, and about as long as the protarsus and half the tarsus of the first leg; length from fovea to anterior border slightly less than tibia of second leg; width a little exceeding the tibiæ of first and fourth legs. Anterior median eyes (*in alcohol*) about a diameter apart; distance between anterior median and posterior lateral about twice the diameter of the former, the outer rim of the posterior medians on a level with those of the anterior medians; distance between posterior medians about one fourth greater than distance between posterior median and posterior lateral on each side.

Legs 4, 1, 2, 3, the fourth and first subequal; patella and tibia of the fourth a little longer than of first; tibia of first as wide as the femur, slightly incrassate, armed below with about twelve external spines and internally with about six, bearing two stout processes at its distal end, the distal of the two the largest, bluntly rounded, but with a sharp spiniform process above; the other a little higher up, behind it, and conically sharpened; protarsus concave internally at the base, with a low process tipped with half a dozen strong spines, armed in addition with about a dozen inferior external spines and about six or seven in the distal half of the inner surface; tarsus with an inner row of six spines and about a dozen inferior external spines; lower surface of protarsus and tarsus covered with hairs and spinules below; second leg spined much as in the first; third leg with patella and tibia armed in front above with about twelve short spines; a few dorsal spines; the tibia, in addition, with a series of short spines behind and about two pairs of setiform spines below; protarsus with numerous spines above, below, and at the sides; tarsus with spinules in front and behind; fourth leg with patella armed with short spines in front; tibia with a few setiform spines below; protarsus with about twelve setiform spines below, three of them at the apex as on the third leg; tarsus spinulose in front, more scantily behind; all the tarsi scopulate below, the scopula increasing in thickness from the

first to the fourth; femora with a weak line of spinules above; *claws* of first, second, and third armed with five to seven long teeth in a single series, those of the fourth with only two basal teeth and a few smaller ones.

Palpus short, only just surpassing the apex of the femur of the first leg when the two are extended, unarmed except for one spine at the apex of the tarsus; tibia half as long again as the patella, more than twice as long as the tarsus, nearly three times as long as broad, not so broad as high, its upper edge strongly convex, thickly furnished with long hairs below; a shallow depression or notch on its inner side for the reception of the tip of the palpal organ; tarsus strongly convex at the base, hooked at the apex; spine of palpal organ acute at the tip, spatulate above the tip, with a short spiral twist.

Measurements in millimetres.—Total length of trunk 16, of carapace 8, width 7; length from fovea to anterior border 4·7; width of ocular tubercle 2; length of palpus 11·5; length of first leg 30·5, second leg 27, third leg 22, fourth leg 31; patella, tibia, and tarsus of palp 6·5; patella and tibia of first leg 10·5, of fourth 11; protarsus of fourth 7·8.

A single male example from Pretoria (*W. L. Distant*).

The three African species of *Acanthodon* known to me and represented only by male specimens may be recognized as follows:—

- a. Tibia of palp with only a shallow external notch, furnished below externally and internally with long bristles; protarsus of first leg concave at the base on the inner side, in front of the concavity a low prominence tipped with spines *pretoriae*, sp. n.
- b. Tibia of palp with a conspicuous external notch, bounded behind by a spine-tipped prominence or ridge; no spine-tipped process on the base of the protarsus of the first leg.
 - a¹. Of large size (carap. nearly 12 mm. long); carapace coarsely granular; tibia of palp strongly inflated, with a deep notch and a large spine-tipped process on the outside; protarsus of first leg distinctly curved *Meadii*, Cambr.
 - b¹. Of small size (carap. about 4·5 mm. long); carapace much less coarsely granular; tibia of palp less inflated, with a shallower notch and a smaller spine-tipped prominence; protarsus of first leg straight *Thorellii*, Cambr.

A. Meadii, Cambr. (Proc. Zool. Soc. 1870, p. 152, pl. viii. fig. 4), from East Africa, further differs from *pretoriae* in

being much more granular on the carapace, and also in leg-measurements, the patella and tibia of the fourth being considerably longer than those of first; length from fovea to anterior border exceeding tibia of second leg, the width considerably exceeding tibia of first leg; the palpal organ is bifid at the tip.

A. Thorellii, Cambr. (*loc. cit.* p. 156, pl. viii. fig. 6), from South Africa, is a longer-legged species than *pretorice*, the carapace being about equal to the fourth tibia and less than its protarsus.

LIII.—*List of the Arachnida and "Myriopoda" obtained in Funafuti by Prof. W. J. Sollas and Mr. Stanley Gardiner, and in Rotuma by Mr. Stanley Gardiner.* By R. I. POOCK, of the British Museum (Natural History).

THE specimens forming the subject-matter of the following pages were collected by Prof. Sollas and Mr. Gardiner on the expedition sent out under the auspices of the Royal Society and British Association to Funafuti, in the Ellice Archipelago, to investigate the formation of coral atolls in the Pacific. Mr. Hedley was sent from the Australian Museum, Sydney, to join the expedition, and collections of the various forms of life observed in the island were obtained.

Upon their return to England Prof. Sollas and Mr. Gardiner kindly asked me to examine the Myriopod and Arachnid material they had brought back and to publish a list of the species should any forms amongst them prove to be of interest.

Meanwhile the collections obtained by Mr. Hedley were without delay placed for determination in the hands of members of the staff of the Sydney Museum, and reports of the results were issued with startling, if injudicious, rapidity. The bulk of the terrestrial Arthropoda were entrusted to Mr. Rainbow, who quickly prepared a list* of the Coleoptera, Hymenoptera, Lepidoptera, Diptera, Orthoptera, Pseudoneuroptera, Myriapoda (Chilopoda), and all the Arachnida referable to the orders Scorpiones, Chelonethi (Pseudoscorpiones), Acari, and Araneæ. Of the Chilopoda but one species was recorded, namely *Scolopendra platypus*, Brandt,

* *Vide* 'Memoirs of the Australian Museum,' iii., "The Atoll Funafuti &c.," pt. 2, pp. 89-124 (1897).

the species to which the name *morsicans* is applied in this paper. Of the *Arachnida*, on the other hand, no fewer than twenty-five species, represented by eighty-eight specimens, were identified, and of these, fifteen—that is to say, 60 per cent.—were regarded as new.

Prof. Sollas and Mr. Gardiner were less fortunate, for although a larger number of specimens were obtained by them, the number of species amounts only to eight, and all of these, with the single possible exception of *Garypus longidigitatus*, appear to me to be well-known Oriento-Australian forms. In fact the fauna bears exactly the character that one would venture on *a priori* grounds to prophesy for an atoll occupying the position of Funafuti. That a new scorpion should turn up in such a spot is in the highest degree improbable; and when it is seen that Mr. Rainbow's so-called new species is placed in a genus and family to which it obviously does not belong, one's confidence in its novelty is rudely shaken, and an unfavourable reflection is cast upon his determination of some of the other species of *Arachnida*.

No doubt this scorpion, as well as most—possibly all—of the spiders, has been introduced by human agency either within or before historic times. Some of the spiders, however, may have reached the island by that means of distribution known as “ballooning”—that is to say, floating on webs in early life, a habit which is so marked a characteristic of the smaller species. The False Scorpions, too, may have been introduced by man; but the members of this order also have exceptional means of dispersal in connexion with flies, beetles, and other winged insects, to which, as is well known, they habitually cling. So that, although I am not sufficiently well acquainted with the Pseudoscorpion fauna of the Oriental and Australian regions to say whether the species described as *Chelifer longidigitatus* by Rainbow has previously received a name or not, it is permissible to suppose that it will prove not to be peculiar to Funafuti. The same opinion may be held concerning the one and only species of Millipede obtained on the island, except that the species has certainly not been previously described. As for the Centipedes, they are notoriously widely distributed Oriento-Australian species, a remark which also applies to all the spiders that came into my hands for examination.

The fauna of the island of Rotuma, which Mr. Gardiner took the opportunity of visiting, bears much the same stamp as that of Funafuti, except that it appears to be richer in species belonging to types which have perhaps scarcely so wide a range as those obtained in Funafuti.

It is interesting that in both islands a new species of Millipede belonging to widely distributed Oriental genera was obtained.

I.—LIST OF THE SPECIES FROM FUNAFUTI.

Class ARACHNIDA.

SCORPIONES.

(1) *Hormurus australasiæ* (Fabr.).

To the many synonyms of this widely distributed Orien-Australian species may be added :—

Buthus brevicaudatus, Rainbow, *op. cit.* p. 107, pl. ii. fig. 1.

Evidently abundant, as was to be expected, on the island, Prof. Sollas and Mr. Gardiner obtaining a large number of examples.

PSEUDOSCORPIONES.

(2) *Garypus longidigitatus* (Rainbow).

Chelifer longidigitatus, Rainbow, *loc. cit.* p. 108, pl. ii. fig. 2.

Prof. Sollas obtained in Funafuti a few specimens of False Scorpions, which, though referable to the genus *Garypus*, appear to me to be specifically identical with the species Mr. Rainbow described as *Chelifer longidigitatus*, the figure and description of the latter being just sufficient to show that the form in question does not possess the characters of the family Cheliferidæ, but of the Garypidæ and of the genus *Garypus*.

(3) *Olpium longiventer*, Keyserling.

Prof. Sollas obtained many examples of a species of *Olpium* which appear to be identical with the form described as *longiventer* by Keyserling from Peack Downs in Queensland.

According to Mr. Rainbow, Mr. Hedley collected specimens of *Obisium antipodum* in Funafuti. I venture, however, to suggest that the specimens identified as *O. antipodum* may be cospecific with those here referred to *Olpium longiventer*.

ARANEÆ.

(4) *Araneus theîs* (Walck.).

This species is exceedingly widely distributed over the

Indo- and Austro-Malayan subregions, in the Polynesian Islands, and Australia.

The characters and the extent of their variation in this species have been repeatedly discussed by Thorell since 1877 (see Ann. Mus. Genova, x. pp. 390-396, 1877; *op. cit.* xiii. p. 65, 1878; *op. cit.* xvii. pp. 114-116, 1881; *op. cit.* xxviii. p. 151, 1890).

The following "species novæ" described by Mr. Rainbow from Funafuti are, I believe, merely synonyms of *theis*:—*Epeira ventricosa*, p. 110; *longispina*, p. 111; *multispina*, p. 112; *Etheridgei*, p. 114; *festiva*, p. 115; *obscura*, p. 116; *annulipes*, p. 117; *distincta*, p. 118; *Hoggi*, p. 119; *speciosa*, p. 120.

Prof. Sollas and Mr. Gardiner obtained a large number of specimens of this species, including adults and immature of both sexes. The male specimens agree with the male of *multispina* as described by Mr. Rainbow * and with the males of *theis* as described by Dr. Thorell.

(5) *Tetragnatha ponapea*, L. Koch.

Specimens agreeing with the description of this species, which was recorded from Upolu, were collected by Prof. Sollas.

Mr. Rainbow records *T. laqueata* from Funafuti.

(6) *Uloborus geniculatus* (Oliv.).

Several examples (*Sollas*). Also recorded by Rainbow. Cosmopolitan in distribution.

(7) *Heteropoda venatoria* (Linn.).

Many specimens (*Sollas and Gardiner*).

This is the species which Mr. Rainbow, following L. Koch, identifies as *Sarotes regius*. Mr. Rainbow also records *Sarotes debilis* of L. Koch from the island; but since no reasons for the identification are given, it is not possible to offer an opinion as to the accuracy of the determination.

(8) *Ascyltus pterygodes* (L. Koch).

A few specimens (*Sollas and Gardiner*).

The two species described by Mr. Rainbow as *Hyllus ferox* and *audax* (p. 112, pl. v. fig. 3, and p. 124, fig. 4) appear to

* Pl. iii. fig. 4a does not illustrate the lower side of the trochanter of this spider, as stated, but the lower side of the tibia.

be referable to this form recorded by Koch from Upolu and Tonga.

Mr. Rainbow also records:—*Araneus plebeius*, *Dictis striatipes*, *Clubiona alveolata*, and *Acompse suavis*.

Class CHILOPODA (CENTIPEDES).⁶

(1) *Scolopendra morsicans* *, Linn.

Obtained by Mr. Gardiner. Also recorded by Mr. Rainbow.

(2) *Otostigmus astenon* (Kohlrausch).

Obtained by Prof. Sollas and Mr. Gardiner.

(3) *Mecistocephalus punctifrons*, Newp.

Obtained by Mr. Gardiner.

(4) *Orphnæus phosphoreus* (Linn.).

Obtained by Prof. Sollas.

Class DIPLOPODA (MILLIPEDES).

IULOIDEA.

(1) *Trichocambala Sollasi*, sp. n.

Colour of body a uniform dullish brown above, yellowish below; a conspicuous black spot marking the position of the pores and a conspicuous reddish spot a little distance above the base of the legs; legs yellowish red; antennæ and head pale.

Segments smooth, shining; the transverse sulcus strong and continued over the dorsum as a distinct groove; the pores situated near the middle of the posterior part of the segment, which is longitudinally grooved infero-laterally; the striæ on the anterior segments extend nearly up to the pore; the setæ appear to be arranged in two transverse rows on the posterior part of the segments, one row just behind the sulcus, the other just in front of the posterior margin; the sterna are not striate.

Length 14, width .8 millim.

Number of segments 46.

* Usually spelt *morsitans*, but Linné uses *morsicans* in the 10th ed. of the Syst. Nat.

A single female example was obtained by Prof. Sollas.

The only other species of this genus, namely *T. elongata*, was described from Sumatra by Silvestri. The description of *elongata* applies to *Sollasii* except so far as colour and size are concerned, *T. elongata* being described as rufo-ferruginous, with pale antennæ and legs, and as being 28 millim. in length. Thus, whatever may be the value of the colour-differences, there can be no doubt that *elongata* is, at all events, twice the size of *Sollasii*.

II.—LIST OF THE SPECIES TAKEN IN ROTUMA.

Class ARACHNIDA.

SCORPIONES (SCORPIONS).

(1) *Hormurus australasiæ* (Fabr.).

Ranging from Burma to Australia.

(2) *Isometrus europæus* (L.) (= *maculatus*, auct.).

Cosmopolitan.

ARANEÆ (SPIDERS).

(3) *Nephila venosa*, L. Koch (= *prolixa*, L. Koch).

This species was recorded by Koch from the Tonga, Fiji, and Samoa Islands, and also from Rockhampton, Brisbane, Port Mackay, and by Thorell from Cape York.

4. *Araneus (Cyrtophora) molluccensis* (Dol.).

Ranging at least from Ceylon to the Australian islands.

(5) *Araneus theïs* (Walck.).

Widely distributed in the Oriental and Australian regions.

(6) *Heteropoda venatoria* (L.).

Cosmopolitan.

(7) *Plexippus Paykulli* (Aud.).

Cosmopolitan.

(8) *Plexippus foliatus* (L. Koch).

Recorded by Koch from Upolu, Huahine, Tahiti, &c.

(9) *Erasmia nigrovittata*, L. Koch.

Recorded by Koch from the Tonga Islands.

Mr. Gardiner also obtained in Rotuma a few small spiders belonging to the families Pholcidae and Theridiidae, but I am not sufficiently well acquainted with the smaller representatives of these groups to assign names to them.

Class CHILOPODA (CENTIPEDES).

(1) *Ethmostigmus** *platycephalus* (Newp.).

Recorded from New Guinea, Tahiti, Halmahera, &c.

(2) *Otostigmus astenon* (Kohl.).

Apparently ranging from the Philippines to the Tonga Islands.

(3) *Scolopendra morsicans*, Linn.

Cosmopolitan.

(4) *Mecistocephalus castaneiceps*, Haase.

Previously known from Christmas Island, Pulo Edam off the north coast of Java, and the Andamans.

Class DIPLOPODA (MILLIPEDES).

IULOIDEA.

(1) *Trigoniulus Goësi* (Porat).

Cosmopolitan. Carried everywhere by human agency.

POLYDESMOIDEA.

Family Strongylosomatidae.

(2) *Orthomorpha coarctata* (Sauss.).

Cosmopolitan. Carried by human agency.

* New name for *Heterostoma*, Newp. 1844, preoccupied by Hartmann in 1843, and *Dacetum*, C. Koch, 1847, preoccupied as *Daceton* by Perty, 1830.

Family *Cylindrodesmidæ*, nom. nov.(=*Haplosomidæ*, Silvestri; *Haplodesmidæ*, Cook.)Genus *CYLINDRODESMUS*, Poc.*Cylindrodesmus*, Pocock, Proc. Zool. Soc. 1888, pp. 558-560.*Haplosoma*, Verhoeff, Zool. Anzeiger, xvii. p. 8, 1894 (nom. præocc.).*Haplodesmus*, Cook, Ann. New York Acad. ix. p. 4.

A re-examination of the type species of *Cylindrodesmus*, namely *hirsutus*, from Christmas Island, has failed to reveal to me any satisfactory character by which this genus can be distinguished from the later-described form *Haplodesmus*, Cook (= *Haplosoma*, Verh.). An apparent discrepancy lies, it is true, in the fact that Verhoeff assigns nineteen body-segments to his form, while twenty were, by implication, assigned by me to *Cylindrodesmus*. As a matter of fact, the adult male of the latter has nineteen segments and the adult female twenty and thirty-one pairs of legs. But the female of Herr Verhoeff's species is said to resemble the male in this character. I venture to think, however, that the presence of nineteen segments in the female of *Strubelli*, the type of *Haplodesmus*, is due to the immaturity of the specimens examined, an opinion which is borne out by the opening words of Verhoeff's specific diagnosis:—"Körper der Männchen hellbraun, der Weibchen weisslich."

In the specimens of the two species that I have examined the adult female is the same pale brown tint as the adult male, while the immature female is much paler.

It may be added that, both in the figure and description of *hirsutus*, the prominence of the labrum is exaggerated.

The cuticle of *hirsutus* is thickly covered with short hairs, amongst which are scattered here and there long bristles or short cylindrical blunt-tipped bristles, apparently representing the basal segment of the longer setæ, which persist especially along the hinder border of the segments or at the sides, where there is protection from rubbing. The sternal surfaces are coxiform, being deeply grooved transversely and longitudinally.

In the legs the trochanters ("femora," Verhoeff) are about twice the length of the coxæ and about two thirds the length of the femora ("tibix," Verhoeff); the patellæ and tibix are very short and subequal, taken together shorter than the femur; the tarsus is the longest segment, being longer than the femur; the proportion varies, however, a little in different parts of the body. The anal sternite has two prominent angular tubercles, from each of which a long bristle emerges.

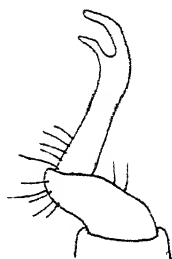
In the female the ventral area of the third segment is raised behind the sternal piece to which the legs are articulated, into a convexly margined plate. In the male the distal segment of the copulatory organ arises on the inner surface of the apex of the basal segment, and is curved inwards to meet its fellow of the opposite side, the two then running forwards closely in contact with each other, the apex being curled ventrally and very slightly bifid.

(3) *Cylindrodesmus villosus*, sp. n.

Colour of adult a pale yellowish brown, the sixth segment of the antennæ infusate; the forehead darker than the lower part of the head.

The female of this species differs in scarcely anything, so far as I have noticed, from *C. hirsutus*; but the male may be at once recognized from the male of *hirsutus* and of *Strubelli* by the form of the copulatory organ, which ends in two subsimilar ventrally turned branches, of which the proximal is much shorter than the distal.

Length of female up to 5.5 millim.



The males of the three known species may be recognized as follows:—

- a. Apex of copulatory organ simple or very slightly divided; length 7–8 millim.
 - a¹. Apex of the copulatory organ bent ventrally and weakly bifid *hirsutus*, Poc.
(Christmas Island.)
 - b¹. Apex of copulatory organ undivided and bent dorsally *Strubelli* (Verh.).
(Amboina.)
- b. Copulatory organ ending distally in two subsimilar branches directed ventrally; length up to 5½ millim. *villosus*, sp. n.
(Rotuma.)

LIV.—On a new Genus of Salmonoid Fishes from the Altai Mountains. By G. A. BOULENGER, F.R.S.

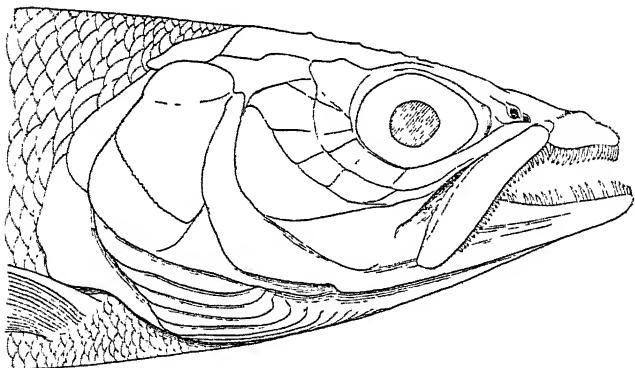
A SINGLE example of a remarkable Salmonoid from the south side of the Altai Mountains, on Chinese territory, was brought home by Mr. St. George Littledale from his recent expedition, and presented by him to the British Museum. The specimen was unfortunately dried, and reached the

Museum in a mummified condition; but I have succeeded by careful soaking in restoring its appearance to a certain extent and rendering it fit for description. It is now preserved in spirit. It must be made the type of a new genus, which I propose to call

PHYLOGEPHYRA.

Mouth large, both jaws equal in front, the lower articulating with the suspensorium just behind the vertical of the orbit. Teeth strong, curved, close together, in one row in the præmaxillary, maxillary, and mandible, in a large cardiiform patch on the head of the vomer, in another on the tongue, and in two series on the palatines. Branchiostegals 11. Dorsal rather elongate, with 20 rays, the four anterior adnate and unbranched; anal moderate, with 15 rays, the three anterior adnate and unbranched. Scales moderate. Anterior ribs with epipleurals.

Phylogephyra altaica.



Side view of head, natural size.

Depth of body 5 times in total length, length of head $3\frac{3}{4}$ times. Snout rounded, not projecting, $1\frac{1}{2}$ diameter of eye, which is 5 times in length of head and $1\frac{1}{4}$ in interorbital width; maxillary 4 times as long as deep, $2\frac{3}{4}$ in length of head, extending to below posterior third of eye; supplemental maxillary small. Gill-rakers moderately long, slender, 11 on lower part of anterior arch. Dorsal equally distant from the end of the snout and the base of the caudal, its length equal to $\frac{2}{3}$ that of the head, the longest rays $\frac{1}{2}$ the latter length. Adipose fin small, more than twice as far from the dorsal

than from the base of the caudal. Pectorals $\frac{2}{3}$ length of head. Ventrals inserted below posterior third of anal. Base of anal $\frac{1}{2}$ that of dorsal. Caudal forked, scaly. Caudal peduncle twice as long as deep. Lateral line straight, along 72 scales, separated from the dorsal by 8 rows of scales.

Total length 290 millim.

The name chosen for this genus is intended to express the important fact that it completely bridges over the gap believed to exist at the present day between the two groups usually designated as Salmoninæ and Coregoninæ. Whilst agreeing with the former in the large mouth with long and narrow maxillary, the strong and complete dentition, and the mandibular articulation behind the vertical of the orbit, it conforms to the second as regards the other characters, and approaches the genus *Thymallus* in particular—so much so, that I have even for a moment entertained doubts as to the fish here described being distinct from Kessler's *Thymallus brevirostris*, from the same district, and which is also stated to differ from the typical *Thymallus* in the longer maxillary bone, nearly reaching to below the posterior border of the eye. However, nothing is said of the dentition of this *T. brevirostris*, an omission which, on the part of so able an ichthyologist as the late Dr. Kessler, implies practical identity with the species to which it is compared, and the shape of the snout and the number of anal rays (11–12) also point to specific difference. It is, however, probable that an examination of *T. brevirostris* would show a certain approximation to the fish here described, and supply a further link in the chain connecting the extreme types of Salmonoids.

PROCEEDINGS OF LEARNED SOCIETIES.

GEOLOGICAL SOCIETY.

November 3rd, 1897.—Dr. Henry Hicks, F.R.S.,
President, in the Chair.

Mr. W. W. WATTS proceeded to give details of some interesting geological features recently exposed at the new Sewerage Works at Carshalton, Surrey, now being made by the Urban District Council. to which the attention of the Society had been directed by the Surveyor during the autumn recess.

These excavations are situated at a spot which on the Geological Survey map is coloured as London Clay; and the features of the ground fully justified this colouring. The excavations, however, have shown that there are loamy and sandy beds of a light yellow

colour, some 14 or 15 feet in thickness, and apparently occupying a hollow in the London Clay. At the base these sandy beds become dark and clayey in some places, and include flints and pebbles, while below this is the London Clay. In the dark pebbly layer were found a large skull, a piece of a tusk, and a number of smaller bones, which Mr. E. T. NEWTON has determined to be a piece of elephant-tusk, the skull (31 inches long) of *Rhinoceros antiquitatis* with some of its limb-bones; while the smaller bones represent two or perhaps three horses. Although the teeth of the rhinoceros are wanting, the skull is otherwise very perfect; and, bearing this in mind, as well as the fact that certain of the limb-bones were also found, and that *Elephas* is represented by the tusk, and all three (it is said) at a depth of 14 or 15 feet, little room is left for doubting that we have here at Carshalton a Pleistocene deposit of a somewhat unusual character and at a spot where it was not before suspected.

The following communication was read:—

‘A Contribution to the Palæontology of the Decapod Crustacea of England.’ By the late James Carter, F.R.C.S., F.G.S. (Communicated by Prof. T. McKenny Hughes, M.A., F.R.S., F.G.S.)

This paper deals mainly with the Brachyura. The Author describes several new species, belonging to the genera *Nephrops*, *Gebia*, *Homolopsis*, *Ranina*, *Mithracia*, *Neptunus*, *Actæopsis*, and *Goniocypoda*. The genera *Gebia*, *Ranina*, and *Neptunus* have not been previously recorded from British rocks. *Diaulax* is for the first time identified from the Tertiary strata—a single specimen having been found in the Middle Headon. *Platypodia Oweni*, Bell, is now referred to the genus *Diaulax*; and *Palæocorystes Broderipi*, Bell, to the genus *Eucorystes*.

As a result of the careful study of large series of specimens in various collections, the Author is able to give much additional information concerning the morphology of several species.

MISCELLANEOUS.

Slugs from “Borneo”: a Correction. By WALTER E. COLLINGE.

IN two recent papers of mine (P. Z. S. 1897, p. 778, and Ann. & Mag. Nat. Hist. 1898, i. p. 191) an unfortunate error has crept in through the introduction of the term “Borneo.” The slugs described in both of the above papers were collected in the island of *Lombok* opposite Bali; the habitat should therefore read “*Island of Lombok*,” and not “*Lombok, Borneo*.”

THE ANNALS
AND
MAGAZINE OF NATURAL HISTORY.

[SEVENTH SERIES.]

No. 5. MAY 1898.

LV.—*On the Fossil Cypridinidæ and some Allied Ostracoda.*
By Professor T. RUPERT JONES, F.R.S. &c.

[Plate XVII.]

THE generic name *Cypridina*, proposed by Professor Henry Milne-Edwards in 1838*, and first published by him in 1840, was adopted by palæontologists more than half a century ago† as a modern representative of some small Bivalve Crustaceans found fossil in Devonian and Carboniferous strata, and others in the Cretaceous and Tertiary formations. The figure given by H. Milne-Edwards in his 'Hist. Nat. des Crustacés,' vol. iii. (1840) p. 410, pl. xxxvi. figs. 5-9, unfortunately had no indication of the antero-ventral notch. By a letter, however, dated January 11th, 1856, he definitely informed me that this notch ("l'échancrure du bord antéro-inférieure") was present, but had been inadvertently omitted in the drawing‡. Owing to this omission of a characteristic feature

* Hist. Nat. Anim. s. Vert. édit. 2, vol. v. p. 178.

† By De Koninck in 1841; Sandberger in 1845; subsequently by Richter, Rolle, F. A. Römer, Ferd. Römer, Ludwig, von Keyserling, von Eichwald, von Reuss, Bosquet, and others.

‡ See "Monograph of the Tertiary Entomostraca of England," Palæont. Soc. 1856, p. 9; and "Monogr. British Fossil Bivalved Entomostraca from the Carboniferous Formations," Pal. Soc. 1874, p. 11.

the term "*Cypridina*" was applied to various fossils, as referred to above. The greater number of these misnamed fossils belong to *Cythere*, some to *Entomis**, others to *Cypridella* and *Cyprella*, and even to *Isochilina* and *Leperditia*. On the other hand, other fossils, more truly Cypridinal in character (such as Bosquet's *Cyprellæ* from the Cretaceous and Tertiary beds of Holland and Belgium), being possessed of the anterior notch and beak, were regarded as distinct on that account, and thus misunderstood.

One of the best authorities on the biology of this group of lowly Crustacea, Dr. G. S. Brady, F.R.S., has given the following interesting statement about them:—

"The Cypridinidæ, owing to their considerable size and frequent capture in the surface-net, have attracted more general attention from zoologists than any other division of the Ostracoda; but, compared with the Cypridæ and Cytheridæ, the number both of species and individuals is very small. They appear to be most abundant in the warm surface-waters of the tropical seas, contributing largely to the phosphorescence of those regions. The males only (at any rate of those species which have been thoroughly examined) are endowed with swimming power, the females being non-natatory and passing their lives wholly at the bottom, a condition imposed upon them by the absence of the tuft of long filaments, attached to the first pair of antennæ, which is characteristic of the males. The shape of the shell, too, is usually very different in the two sexes, the male being very long and slender in comparison with the female.

"Judging from the number of fossil species belonging to this family which have been found in the Coal-measures and other Palæozoic formations, we must suppose that the Cypridinidæ were much more abundant in old times than now. So we may perhaps likewise infer that they were chiefly inhabitants of shallow warm water, possibly of brackish and estuarine localities."

The abundance of Cypridinids in some beds of the Carboniferous or Mountain Limestone, which was formed in an open sea, indicates, however, that these bivalved Crustaceans were not confined to littoral areas†.

"Some few species have been described from Cretaceous and Tertiary strata; but it would appear that the group attained the greatest development in the Carboniferous era,

* Particularly in the case of the so-called "Cypridinen-Schiefer" of Germany.

† Some remarks on the fossil forms and their relationships were given in the 'Monthly Microscopical Journal,' vol. x. (1873) pp. 71-76.

and has been gradually losing ground since that time, until it has in our days come to be almost swamped by the smaller, hardier, and doubtless also more prolific species of the families Cypridæ and Cytheridæ, animals evidently of much more plastic organization, and more capable of adaptation to varied conditions of environment." (Zoology of the Voyage of H.M.S. 'Challenger.'—Part III. Report on the Ostracoda. By G. Stewardson Brady, M.D., F.L.S. 1880. Pp. 151, 152.)

A full catalogue of the then known thirty-two species of five genera (*Cypridina*, *Bradycinetus*, *Eurypylus*, *Philomedes*, and *Asterope*), with references and synonyms, are given at pages 152–154; and descriptions of four new species, including one of a new genus (*Crossophorus*), follow, with illustrations.

Thus we see that *Cypridina* is the type of a special group of Ostracods living in the open sea, some crawling on the sea-bed and some swimming free and coming to the surface mostly at night ("crepuscular" in habit). Their bivalve test is usually larger than those of the Cyprids and Cytherids, often globose, or, at least, oval and tumid. A few fossil forms are known in the Tertiary and Chalk formations; but in some of the Palæozoic rocks *Cypridinæ* and their relatives abound, making up the mass of the Carboniferous Limestone at some places (as in the Isle of Man, Lanarkshire, Bolland, Tenby, Cork, Belgium, and elsewhere), just as much as smaller Entomostraca constitute the mass of some Silurian limestones (Malvern, Sweden, Russia) and other limestones of Mesozoic age (at Mountfield in Sussex, Swanage in Dorset), and especially some Carboniferous Oil-shales in Lanarkshire.

Necessarily there remains to the geologist only the hard portion of the structure of these little Crustaceans, such as the bivalve carapace or its separate moieties, all the locomotive and branchial limbs and maxillary apparatus having disappeared. He cannot therefore follow the zoologist closely or decidedly in the detailed study of *Cypridina* and its allies. The shape (outlines and contours) of the carapace and its valves, and occasionally its ornamentation and its muscle-spot, become his chief guides in the discrimination of differences.

Since, however, bivalve tests recognizable as more or less closely resembling those of *Cypridina* remain in the strata, it is evident that they should subserve as far as possible in the characterization of the geological formation to which they belong. Efforts made in this direction have resulted in the recognition of numerous generic forms which can be referred to that group of the Ostracoda which is known as the

MYODOCOPA, including the Cypridinidæ, Conchœciidæ, and the Entomoconchidæ. The next allied group is the CLADOCOPA, represented by the Polycopidæ only. Another group is the PLATYCOPA, having the Cytherellidæ only. See Dr. G. S. Brady's memoir in the Trans. Linn. Soc. vol. xxvi. (1868) pp. 355 *et seq.*, for the classification by Dr. G. O. Sars.

The geological distribution of these and other Ostracods, as well as some of the Phyllopods (as far as known), is approximately shown in the Table on pp. 336 & 337.

My purpose is now to draw attention to the most noticeable of the fossil forms alluded to in the accompanying Table; beginning with those from the Lower Silurian rocks, and rising up through the Upper Silurian and Devonian to the Carboniferous and Permian formations (in the third of which Cypridinids abound), we shall have to pass by most of the Mesozoic series to reach the specimens from the Cretaceous and the Tertiary strata, of which we know something.

As a knowledge, however, of the recent forms is necessary, the student is referred to Dr. G. S. Brady's masterly expositions of the internal structure and external characters of the recent species so assiduously studied by himself, G. O. Sars, C. Claus, Fr. Müller, and others.

1. The oldest rock in which *Cypridina* first appears in unmistakable form is *C. Raisiniæ*, J., probably of Lower Silurian (Ordovician) age, as far as can be determined. It measures 9 by 5 millim. See Quart. Journ. Geol. Soc. vol. xlix. (1893) pp. 163, 164, with a woodcut. Miss Raisin discovered the fossil "in an indurated argillite," associated with the volcanic rocks of Pared-lllech-y-menyn, on the south coast of the Lleyn promontory, North Wales. (Pl. XVII. fig. 18.)

"Analogous features in various degrees, and associated with other characteristics, exist in *Cypridina Reynaudii*, Milne-Edwards, *C. elongata*, Brady, *C. Bairdii*, Brady, *C. japonica*, Brady, and other hooded and apiculate members of the genus; but none of these have the hinder end tapering away to so long and strong a point. A fossil form, however, from the Carboniferous series of Sicily, described and figured by Prof. G. G. Gemmellaro (*Philomedes acanthoides*, Gemm. Mem. Soc. Ital. Sci. ser. 3, vol. viii. 1890, p. 37, pl. v. figs. 16 and 17), is very similar, but is too attenuate, and measures 6.5 by 3 millim."

2. Another specimen, also of Lower Silurian age, is *C. Grayæ*, J., Quart. Journ. Geol. Soc. vol. xlix. (1893) pp. 305, 306, pl. xiv. fig. 12. This is from the grey shales of Whitehouse Bay, near Girvan, Ayrshire. It measures 1·08 by ·76 millim. In shape it nearly resembles the Carboniferous *C. Youngiana*, Jones and Kirkby. (Pl. XVII. fig. 17.)

3. Among his Silurian fossils from the River Srednjaja, in the New-Siberian Island of Kotelny, Baron Eduard von Toll has found a specimen which he has described and figured as "*Leperditia* (?) sp.," but which may possibly belong to the Cypridinids.

In the 'Mémoires Acad. Impér. Science St.-Pétersbourg,' sér. 7, vol. xxxvii. no. 2, 1859, p. 45, pl. iii. fig. 20, this doubtful little fossil appears to be a not well-preserved cast of a left valve that has a truncated front margin with a shallow notch. Some delicate wavy striæ, passing obliquely backwards and downwards, mark the anterior moiety of this fossil as far as the relatively large oval subcentral muscle-spot. The notch, though weak, and the muscle-spot suggest an alliance with *Cypridina*. The valve is 7 millim. long. (Pl. XVII. fig. 14.)

4. An Upper-Silurian form closely related to *Cypridina* is the *Cyprosis Haswellii*, J., Geol. Mag. dec. ii. vol. viii. (1881) p. 338, pl. ix. figs. 6 a, 6 b. It measures 10 by 7 millim.

The late Mr. G. C. Haswell found it in the Upper Silurian mudstones on the west side of the North-Esk Reservoir, in the Pentland Hills, Scotland.

The strong broad vertical sulcus crossing the hinder third of the valve is its distinguishing characteristic. (Pl. XVII. fig. 9.)

This has been referred by M. Barrande * to *Bolbozoe*, but it does not belong to that genus.

5. A bizarre form lately figured by G. Gürich, from the *Cardiola-interrupta* zone (Upper Silurian) in Poland, probably comes within the Cypridinid group. It is of a suboblong form, notched and hooded apparently in front, and impressed with two deep, transverse, curved sulci, giving the surface the appearance of being raised into three unequal lobes. An oval muscle-spot, with twelve radiate marks on each side, is visible near the middle of the valve. The notch and muscle-

* Syst. Silur. Bohême, part i. vol. i. Supplem. (1872) p. 501.

spot remind us of Cypridinal characters (as, indeed, the author himself seems to have thought); but, though some recent species are deeply sculptured, there are none just like this.

This *Cypridina* (?) has been described and figured by Dr. Georg Gürich, of Breslau, in his "Das Palæozoicum im Polonischen Mittelgebirge," in the Verhandl. Russisch-Kaiserl. Mineralog. Gesellschaft zu St.-Petersburg, ser. 2, vol. xxxii. (1896) p. 378, pl. xv. figs. 12 *a, b, c*, as *Bolbozoe polonica*. He found it at Niestachow, Kleczanas, Zalesic, and Brzezinki, in Poland. Specimens vary from 3 to 8 millim. in length. (Pl. XVII. fig. 16.)

6. In one of the pebbles (consisting of a quartzite doubtfully of either Silurian or Devonian age) from the Triassic Conglomerate at Budleigh-Salterton in Devonshire, the late Mr. J. W. Salter found a Cypridinal specimen, which was subsequently figured and described (but not specially named) in the Geol. Mag. dec. ii. vol. viii. (1881) p. 337, pl. ix. figs. 7 *a, b*. It measured 7 by 4.2 millim.

Being a mere cast in granular quartzite, with a part of its edge still imbedded, its real outline could not be determined; but it somewhat resembled certain forms of *Cypridina brevementum* and *Polycope simplex*, figured in the Monogr. Carbonif. Entom., Pal. Soc. 1874. (Pl. XVII. fig. 15.)

7. *Cyprosina Whidbornei*, J., is a Cypridinid peculiar to the Devonian Limestone at Lummaton, near Torquay, Devonshire, as far as known at present. It was described and figured in the Geol. Mag. dec. ii. vol. viii. (1881) pp. 338-340, pl. ix. figs. 1-3 and 5; see also the Rev. G. F. Whidborne's Monogr. Devon. Fauna South England, Pal. Soc. part i. (1889) p. 53, pl. iv. figs. 1-4. Its beak is small, and it has "a short transverse (vertical) sulcus at or near the middle of the ventral region." It occurs of different sizes, the largest measuring about 18 by 12 millim. (Pl. XVII. fig. 8.)

8. In his Monograph on the Devonian Fauna of the South of England, vol. i. part i. (1889), the Rev. G. F. Whidborne describes and figures some rather obscure casts of carapace-valves referable in all probability to *Cypridina* (pp. 45, 46, pl. iv. figs. 6, 10, and 18); *Cypridella* (p. 47, pl. iv. fig. 5); and a new species, *Cypridinella cæca* (p. 46, pl. iv. fig. 16). These range from 3.5 to 10 millim. in length, and were all obtained from the old Lummaton quarries, near St.-Mary-Church, not far from Torquay.

9. From the extensive calcareous formation known as the Mountain-limestone, including the Lower Carboniferous series in Scotland, numerous genera and species allied to *Cypridina* were described and illustrated in 1874 and 1884 in the Palæontographical Society's Monographs, by T. Rupert Jones, J. W. Kirkby, and G. S. Brady. Thus :—

Genera.	Number of Species.	Leading Characteristics in the Fossil Forms.
<i>Cypridina</i>	13	Notch and beak, slight in some, more pronounced in others.
<i>Bradycmetus</i>	1	Beak produced and truncate.
<i>Philomedes</i> (?)	1	Notch deep and broad.
<i>Cypridinella</i>	7	Ovate, produced at each end; more or less apiculate behind; antero-ventral region projecting and prow-like.
<i>Cypridellina</i>	8	Like <i>Cypridinella</i> , but bearing a tubercle or hump above the median line.
<i>Cypridella</i>	6	Like <i>Cypridellina</i> , but having a dorsal sulcus behind the tubercle.
<i>Cyprella</i>	2	Nearly like <i>Cypridella</i> , but annulate.
<i>Sulcuna</i>	2	Subovate, with a deep and oblique sulcus modifying the dorsal region; front truncate; notch obsolete.
<i>Rhombina</i>	2	Oblique-oblong; notch obsolete on the front slope.
<i>Polycope</i>	3	Round or oval, with faint indication of the notch.
<i>Offa</i>	1	Subglobose; front edge truncate and impressed by a nearly central slight turning of the margins of the valves.
<i>Entomoconchus</i>	3	Subglobose; front edge truncate and modified by the margins being pressed inwards, and each forming a sinuous curve, which leaves a long-oval opening below a short beak, and a narrower and shorter slit in the ventral region.

10. From the Coal-measures only a few Cypridinids have been obtained. *Cypridina radiata*, Monogr. Carb. Entom., Pal. Soc. 1874, p. 14, pl. v. figs. 6 a-6 f; and *Philomedes elongata*, Monogr. Carb. Entom. 1884, p. 81, pl. vi. figs. 1 a-1 c. The former from Scotland, and the latter from England, have both a peculiar radiate structure of the test.

11. In a memoir by Professor G. G. Gemmellaro, "On the Crustacea of the *Fusulina*-limestone of the Valley of the Sosio River, in the Province of Palermo, Sicily," Mem. Soc. Italiana delle Scienze fiss. e nat. vol. viii. ser. 3, no. 1, 40 pages, with 5 plates (4to, Naples, 1890), he refers to this limestone as being a "Permo-Carboniferous" formation;

and, besides other Crustaceans—Macrurous, Brachyurous, and of doubtful affinities—he describes (pp. 30–40) and figures (pl. v. figs 3–46) numerous Ostracoda, including:—*Cypridinella*, J. & K., 2 new species; *Cypridellina*, J. & K., 1 new species; *Cypridella*, De Koninck, 2 new species; *Cypridina*, Milne-Edwards, 2 new species; *Philomedes*, Lilljeborg, 1 new species; *Entomoconchus*, M'Coy, 1 new species; *Entomis*, Jones, 2 new species. All these have an exceedingly close resemblance to the true Carboniferous species of Britain and Belgium, and at first sight might in most instances be taken for them.

12. Two small specimens of a true Cypridinal form have been met with in the Permian Limestone of Sunderland (Monogr. Carbonif. Entom. 1874, p. 13, pl. ii. fig. 28). They closely resemble *Cypridina primavera* (*Daphnia*, M'Coy), in the Carboniferous Limestone. (Pl. XVII. fig. 5.)

13. Having nothing definite to record as to the Cypridinids that may have existed in the seas of the early Mesozoic period, we arrive at the Upper Mesozoic series, certain Cretaceous deposits of which, in Limbourg and Belgium, yielded to the researches of the late M. J. A. H. Bosquet, of Liège, some small, rare, and fragile specimens, which he referred to De Koninck's *Cyprella*, because Milne-Edwards's figure of *Cypridina Reynaudi* showed no beak and notch. See 'Mémoires de la Commission pour la Description de la Carte Géologique de la Neerlande,' vol. ii. (1854), p. 124; they had been referred to *Cypridina* in the Monogr. Cretac. Entom., Pal. Soc. 1849, pp. 3 and 36.

Cypridina ovulata (*Cyprella*, Bosquet), "Descript. Entom. foss. Craie de Maestricht," Mém. Soc. Roy. Sci. Liège, vol. iv. (1847) p. 373, pl. iv. figs. 4 a, b, c. Carapace gibbose, boldly pitted, and bearing a large subradiate muscle-spot. Length 2 millim., height 1·4 millim., and 1·2 in thickness. From the whitish Maestricht Chalk between Mont St. Pierre and Petit Lanaye, and at Sichen, in Belgium. Also in his "Monographie des Crustacées fossiles du Terrain Crétacé du Duché de Limbourg" (Mém. Comm. Descrip. Carte géol. Neerlande, vol. ii.), p. 124, pl. ix. figs. 11 a, b, c. (Pl. XVII. figs. 3 a, b.)

Cypridina Koninckiana (*Cyprella*, Bosquet), *ibid.* 1847, p. 373, pl. iv. figs. 5 a, b, c. Surface showing a large and partly radiate muscle-spot, and on its hinder moiety a triangular area of radiate punctation. Size 1·2 by ·7 millim. From the Maestrichtian Chalk at Mont St. Pierre, Gronsveld,

Keer, and Bemelen; and in the same series at Petit Lanaye and at Sichen in Belgium. *Ibid.* 1854, p. 125, pl. ix. figs. 12 *a*, *b*, *c*. (Pl. XVII. figs. 4 *a*, *b*.)

14. M. J. Bosquet also found some specimens of a Tertiary Cypridinid in the Eocene beds of France, and he described it as a *Cyprella*, with illustrations. "Descript. Entomost. foss. Terr. Tert. France et Belgique" (Mém. cour. Acad. Roy. Belgique, 1852, p. 132, pl. vi. figs. 14 *a*, *b*, *c*, *d*). This is the neatly punctate, oval *Cypridina Edwardsiana* (*Cyprella*, Bosquet), *loc. cit.* Length 1.2, height .75, and thickness .7 millim. It was obtained from the "Sables Moyens" of Ver (Oise) and of Tancrou (Seine-et-Marne), also from the "Calcaire Grossier" of Chateaurouge, of Parnes and Chaumont (Oise), and of Orme and Grignon (Seine-et-Oise). (Pl. XVII. fig. 2.)

15. While sorting and examining, several years ago, some material of a friable calcareous deposit of Eocene age from Orglandes, Dép. Manche, France, procured by Sir C. Lyell in 1851, the writer met with a broken valve of a symmetrical little *Cypridina* of the not unusual broad oval shape, with a small neat hood and notch. Surface smooth, but bearing a rather obscure radiate muscle-mark. The fragment (fig. 1 *a*) is 6 millim. long, the smaller moiety of a valve probably 9 millim. long; the height of the valve is 6 millim. and the thickness of the carapace was 5 millim., the valve being $2\frac{1}{2}$ millim. in depth or thickness. (Pl. XVII. figs. 1 *a*, *b*, *c*.)

EXPLANATION OF PLATE XVII.

- Fig. 1.* *Cypridina* from the Tertiary of Orglandes, France. *a*, anterior moiety of a left valve; *b*, outline of end view; *c*, outline of edge view.
- Fig. 2.* *Cypridina Edwardsiana* (Bosquet). Eocene, France.
- Fig. 3.* *Cypridina ovulata* (Bosquet). Maestricht Chalk Series. *a*, left valve; *b*, ventral aspect.
- Fig. 4.* *Cypridina Koninckiana* (Bosquet). Maestricht Chalk Series. *a*, left valve; *b*, aspect of the inside with the hinge.
- Fig. 5.* *Cypridina primæva* (M'Coy). Carboniferous Limestone (and Permian). Left valve.
- Fig. 6.* *Bradycinetus Rankinianus*, Jones and Kirkby. Carboniferous Limestone. Right valve.
- Fig. 7.* *Philomedes* (?) *Bairdiana*, Jones and Kirkby. Carboniferous Limestone. Right valve.
- Fig. 8.* *Cyprosina Whidbornei*, Jones. Devonian. Left valve.
- Fig. 9.* *Cyprosis Haswellii*, Jones. Upper Silurian. Left valve.
- Fig. 10.* *Cypridinella Maccoyiana*, Jones and Kirkby. Carboniferous Limestone. Right valve.

- Fig. 11. *Cypridellina Burrovii*, Jones and Kirkby. Carboniferous Limestone. Right valve.
 Fig. 12. *Cypridella Koninckiana*, Jones. Carboniferous Limestone. Right valve.
 Fig. 13. *Cypridella annulata*, De Koninck. Carboniferous Limestone. Left valve.
 Fig. 14. *Cypridina*? (*Leperditia*?, von Toll). Silurian. Left valve.
 Fig. 15. *Cypridina*? Devonian or Silurian? Right valve.
 Fig. 16. *Cypridina*? *polonica* (*Bolbozoe*, Gurich). Upper Silurian. Right valve.
 Fig. 17. *Cypridina Grayæ*, Jones. Lower Silurian. Left valve.
 Fig. 18. *Cypridina Raisiniæ*, Jones. Lower Silurian. Left valve.
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LVI.—*List of the Phytophagous Coleoptera obtained by Mr. W. L. Distant in the Transvaal, with Descriptions of the new Species.* By MARTIN JACOBY, F.E.S.

SAGRINÆ.

Sagra bicolor, Lac. Barberton.

CRIO CERINÆ.

Lema crassipes, Oliv.

The single specimen obtained at Rustenburg does not differ in any way from the typical forms from Madagascar, which is interesting, as the latter island has but few species in common with Africa.

Lema hottentotta, Lac. Barberton.

Lema australis, Lac. Barberton.

Lema rufipennis, Lac. Pretoria.

Lema Dregei, Lac. Barberton.

Lema bipunctata, Baly. Natal, Durban.

Crioceris puncticollis, Lac. Barberton.

MEGALOPODINÆ.

Pæcilomorpha afra, Klug. Pretoria, Barberton.

CRYPTOCEPHALINÆ.

Cryptocephalus Distanti, sp. n.

Black, the clypeus flavous; head finely pubescent; thorax fulvous, with two black semicrescentic bands, minutely punctured; elytra rather strongly punctate-striate, the interstices finely punctured, flavous; a transverse band at the base.

nearly connected at the sides with another band below the middle, and the suture black.

Length 4-5 millim.

Head closely and finely punctured, black, clothed with fine yellowish pubescence, the space between the eyes depressed, the clypeus flavous, the labrum and palpi black; antennæ extending to about the middle of the elytra, black, the lower five joints flavous, the upper joints rather robust and thickened; thorax more than twice as broad as long, the sides straight, narrowed towards the apex, the posterior angles acutely pointed, the basal margin with some distinct teeth near the angles, the surface nearly impunctate or with some minute punctures only visible under a strong lens, fulvous, the angles and the margins sometimes pale flavous, the sides with a broad semicrescentic black band of irregular shape, consisting in some specimens of two spots joined together; scutellum short and broad, its apex truncate, black, the middle with a pale flavous spot; elytra with rather strong rows of punctures, the interstices finely and sparingly punctured, flavous, with a broad transverse black band at the base, deeply concave or sinuate at its posterior edge and connected along the suture with another band below the middle, which extends to the lateral margin and nearly joins the anterior band at the sides, the extreme lateral and apical margin likewise black: underside black, finely pubescent; legs fulvous; prosternum broad, truncate at its base and pubescent.

Hab. Johannesburg.

From the black-banded species of Africa the present one may be known by the pubescent head and the crescent-shaped thoracic bands, colour of the scutellum, and the nearly connected elytral bands; the elytra in all the specimens (three) have also the sutural margin round the scutellum marked with pale flavous.

Cryptocephalus decemnotatus, Suffr. Pretoria, Johannesburg, Pinetown.

Many specimens, mostly varieties with a single elytral humeral spot, the thorax with four or two spots.

Cryptocephalus angustofasciatus, Jac. Pretoria.

Cryptocephalus erythromelas, Suffr. Barberton.

Cryptocephalus epipleuralis, Jac. Pretoria.

Cryptocephalus mandibularis, Suffr. Pretoria.

Acolastus nigroplagiatus, Jac. Barberton.

I have also received this species from Estcourt, Natal.

*CLYTRINÆ.**Miopristis Distanti*, sp. n.

Black, labrum and mandibles flavous; head closely punctured; thorax transverse, impunctate, flavous, with two large black patches; elytra pale testaceous, finely punctured, the sutural and lateral margins posteriorly and a spot on the shoulders black.

Length 7 millim.

Head closely punctured at the vertex, finely rugose at the lower portion, the clypeus triangularly emarginate, its lower edge flavous as well as the labrum and the mandibles; antennæ extending to the base of the thorax, twelve-jointed, black, the lower two joints flavous, the intermediate joints more strongly widened than the others, apical joint very narrow; thorax about one and a half times broader than long, convex, the sides strongly rounded as well as all the angles, the anterior margin preceded at the middle by a short but deep and strongly punctured transverse groove, posterior margin scarcely lobed at the middle, the surface entirely impunctate, flavous, the entire sides occupied by a large black ovate patch not extending to the lateral margins; scutellum black; elytra pale testaceous, finely punctured in semiregular rows; a sutural and lateral narrow stripe, abbreviated anteriorly and posteriorly, and a small humeral spot black; the breast and abdomen black, clothed with silvery pubescence; legs flavous, the anterior ones very elongate, their tibiæ curved, with a piceous upper margin, the apex mucronate; the anterior tarsi elongate, piceous.

Hab. Pretoria. A single specimen.

A typical representative of the genus and closely allied to *M. natalensis*, Jac., but at once distinguished by the smooth, shining, and impunctate thorax and the semiregular elytral punctuation.

Clytra impressicollis, sp. n.

Elongate, parallel, black; thorax finely punctured, the sides with a deep sinuate fovea; elytra finely and rather closely punctured, fulvous.

Length 11 millim.

Head deeply depressed between the eyes, black, the latter surrounded by some fulvous pubescence, the vertex with a deep central groove swollen, finely punctured, and strigose; anterior edge of the clypeus semicircularly emarginate; antennæ black, extending to the base of the thorax, the fourth and following joints transversely serrate; thorax about two

and a half times broader than long, black, the sides nearly straight, the posterior angles rounded, the basal margin very slightly and broadly produced at the middle, the surface very finely and closely punctured, partly shining, the sides with a very deep, transverse, sinuate fovea, the base with a transverse groove at the middle; scutellum black, its apex truncate; elytra parallel and very elongate, uniformly fulvous, finely punctured, the punctures here and there arranged in rows; the shoulders rounded, the sides slightly lobed at the base: underside and legs black, clothed with fulvous pubescence; tarsi short and robust, the first joint of the posterior tarsi one half longer than the second joint.

Hab. Zoutpansberg.

I know of no other African species which has the thorax so deeply foveolate at the sides in connexion with the uniformly coloured elytra; only a single (apparently female) specimen is before me.

Titubæa pretoriæ, sp. n.

Black, the head finely pubescent; thorax closely punctured and finely rugose throughout; elytra opaque fulvous, deeply and closely punctured, the apical margin and two broad transverse bands, one before, the other below the middle, bluish black.

Length 11 millim.

Head finely pubescent, black, the vertex swollen, finely punctured, the other portion finely longitudinally strigose, the epistome triangularly emarginate at the apex; mandibles robust; antennæ short, not extending to the base of the thorax, transversely serrate from the fourth joint, the second and third joints small, fulvous; thorax nearly three times broader than long, the sides obliquely narrowed towards the apex, straight, rounded near the posterior angles, the latter obtuse, the median lobe broad, moderately produced, the disk with a narrow transverse depression at the sides, closely and strongly punctured and irregularly rugose and finely wrinkled, black; scutellum triangular, black, rugosely punctured; elytra very deeply and closely punctured, especially so at the lighter-coloured parts, the interstices at the apex tuberculate, the basal margin in shape of a ridge, the colour fulvous; a broad, transverse, medially narrowed band before the middle, another below the latter, not extending to the lateral margins as well as these posteriorly, and the apical margins bluish black: underside and legs densely clothed with silvery pubescence; legs elongate, the first joint of the tarsi as long

as the following two joints together, third joint divided to the middle.

Hab. Pretoria.

Of this species a single (apparently female) specimen was obtained, which in its system of coloration entirely resembles several other African species of the same genus, notably *Lachnea equistris*, Lac., and *L. nigrofasciatus*, Lac.; but the sculpturing of the thorax and the elytra is so entirely different that I think there will not be much difficulty in recognizing the insect. It agrees in the latter respect far better with *Titubœa thoracica*, Jac., but in that species the anterior portion of the thorax is flavous, the elytra are much more finely punctured (although similarly sculptured) and shining, and the tibiæ are fulvous.

Clytra bifasciata, De Geer. Pretoria.

Clytra Wahlbergi, Lac. Waterberg, Pretoria, Pienaar's River, Pietersburg.

Clytra interrupta, Lac. Pretoria.

Antipus fulveola, sp. n.

Black below, above fulvous; head and thorax impunctate; elytra very closely and finely punctured, semiopaque.

Length 7 millim.

Head impunctate, fulvous, with a small fovea at the middle, the anterior edge of the clypeus feebly concave; mandibles robust, black, margined with rufous, the left mandible curved strongly inwards at the apex; eyes rather small, oblong, slightly sinuate; antennæ very short, fuscous, the lower three joints fulvous, the fourth and following joints triangularly widened, but not serrate; thorax more than twice as broad as long, the sides nearly straight, the posterior angles evenly rounded, the posterior margin scarcely lobed at the middle, the surface entirely impunctate, fulvous, shining, the base with a slight transverse sulcus at the middle; scutellum triangular; elytra feebly lobed below the shoulders, extremely finely and closely punctured: underside and legs black, finely pubescent, anterior legs elongate as well as the tarsi, the first joint of the latter as long as the following two joints together.

Hab. Pretoria.

There are two males and one female of this species before me which, on account of reproducing the principal structural characters of *Antipus* on a smaller scale, I have placed in this genus; but the exact position of the insect is, like so many others of this difficult group, a matter of opinion.

At any rate, we have here the same construction of the head as in *Antipus*—that is, there is no distinct epistome and the mandibles are robust and angular. The present species resembles almost entirely the type of the genus, *A. maxillosa*, Lac., but is much smaller; the epistome is of entirely different shape and the mandibles are much less robust; the female does not differ from the male except in the mandibles, which are of normal size and much smaller.

Antipus rufus, De Geer. Barberton and Pretoria.

Peploptera cylindriciformis, Lac. Pretoria, Rustenburg.

Another variety in which the thorax has a longitudinal central black stripe was obtained by Mr. Distant; this variety is not mentioned by Lacordaire, although the insect is one of the most variable of the group.

Peploptera dorsata, Lac. Pretoria.

Peploptera trilineata, Lac. Pretoria.

Gynandrophthalma abdominalis, sp. n.

Black, the antennæ, the tibiæ and tarsi, and the last abdominal segment fulvous; thorax impunctate, fulvous; elytra finely and semiregularly punctured, flavous, the suture narrowly and a broader longitudinal band at the middle of the disk, abbreviated before the apex, black.

Length 7–8 millim.

Subcylindrical and parallel; the head black, rather closely punctured at the vertex, with a central longitudinal groove and a deeper fovea at the middle; clypeus more sparingly punctured, black, shining, its anterior margin subtriangularly emarginate; labrum black, margined with fulvous; palpi and antennæ fulvous, the latter very short, the basal joint piceous above, the fifth and following joints transversely widened; thorax twice as broad as long, the sides rather strongly rounded near the base, the basal margin but slightly produced at the middle, the disk impunctate or with a few minute punctures here and there, reddish fulvous; scutellum black, its apex truncate; elytra not lobed at the base laterally, flavous, finely punctured in very irregular rows, the suture narrowly black, the sides with another broader black stripe, extending from the middle of the base nearly to the apex: underside black, finely pubescent, the last abdominal segment

more or less fulvous; the tibiæ and tarsi flavous, the latter broad, their first joint not much longer than the second.

Hab. Pretoria.

Of this species seven specimens were obtained by Mr. Distant; it is another addition to the little group of black-striped species described by Lacordaire and Lefèvre, but is much larger than either of them, and differs in the colour of the antennæ, and that of the legs and abdomen; in some specimens there is an indication of three blackish spots on the thorax, placed triangularly.

Gynandrophthalma atripennis, Lac. Pretoria.

All the specimens obtained by Mr. Distant belong to the variety in which the apex of the elytra is fulvous; this is probably the normal form, and the one with entirely black elytra which served Lacordaire for the type is the variety.

Melitonoma pictipennis, sp. n.

Black, the labrum and the basal joints of the antennæ fulvous; thorax with the anterior and lateral margins and a central stripe flavous; elytra closely punctured, flavous, a broad lateral stripe from the base to below the middle, two spots near the suture, and a ring-shaped mark near the apex black; legs fulvous.

Length 5 millim.

Head black, closely rugose, the vertex finely punctured, the interstices sparingly clothed with very short silvery pubescence, the anterior margin of the clypeus triangularly emarginate; labrum and palpi fulvous; antennæ not extending to the base of the thorax, the lower five joints fulvous, the others black, the fifth and following joints transversely widened; thorax more than twice as broad as long, the sides rather strongly rounded near the base, narrowed towards the apex; posterior angles rounded, the surface rather closely impressed with larger and smaller punctures, black, the anterior and lateral margins narrowly flavous, this colour also divides the black portion at the middle in shape of a narrow short stripe; scutellum black, shining, triangular, its apex rounded; elytra closely and rather strongly punctured, the interstices very minutely granulate, flavous; a narrow lateral stripe, not extending to the apex, a spot before and another below the middle placed near the suture, as well as an annular mark near the apex, black: underside black, finely pubescent; legs fulvous, the upper edge of the femora with a piceous

stripe, the first joint of the tarsi as long as the following two joints together.

Hab. Pretoria.

The markings and shape of the elytra in this species are quite distinct from any other contained in this genus; the lateral long stripe and the ring-like mark near the apex will at once assist in the recognition of the insect, of which two specimens were obtained; the thorax may also be described as flavous, with two large basal black patches, between which in one specimen there is another small spot, a design which is very frequently met with in species of this and other genera of Clythrinae.

Melitonoma sobrina, Lac. Waterberg.

A single specimen belonging to the variety in which the elytra have four spots instead of five.

Melitonoma duodecimpunctata, sp. n.

Black, the thorax flavous, with two lateral and a medial black spot; elytra very finely punctured, flavous, each with six black spots (1 . 2 . 2 . 1); tibiae and tarsi fulvous.

Length 7 millim.

Head black, shining, the vertex impunctate, the space between the eyes with some fine punctures and irregular depressions, slightly rugose near the eyes; anterior edge of the clypeus slightly emarginate; antennae scarcely extending to the base of the thorax, fuscous, the lower four joints fulvous; thorax three times broader than long, the sides straight, the posterior angles rounded, the surface impunctate, flavous, shining, the base with a subquadrate black patch at each side which sends off a short branch upwards at its anterior edge; a small spot is also placed at the middle of the base; scutellum piceous, triangular, its apex slightly truncate; elytra very finely punctured in closely approached irregular rows, flavous, with a black spot on the shoulders, two placed slightly obliquely at the middle, two others below the latter placed similarly, and a sixth spot at the extreme apex, all the spots rather large and of subquadrate shape: the underside and the femora black; the tibiae and tarsi fulvous, the last rather short and broad, the first joint shorter than the following two joints together.

Hab. Barberton.

The single (apparently female) specimen before me seems closely allied to *M. Simoni*, Weise (Insekt. Deutschl. p. 112), inasmuch as the elytra have six spots on each instead of the

usual five, but the markings of the thorax seem to be of different shape, according to the description, and the legs are given as black; the locality (Ashantee) also differs; but for all that it is possible that the present species is but a variety of *M. Simoni*. Mr. Peringuey has described another six-spotted species, but gives the colour as "olivaceous" and the size as $4\frac{1}{2}$ millim.; the legs are not mentioned. Lastly, *M. galla*, Gestro (Annali d. Mus. Civico d. Genova, 1895), has the elytral spots differently placed and arranged in pairs.

Melitonoma litigiosa, Lac. Pretoria.

EUMOLPINÆ.

Colasposoma fulgidum, Lefèv. Barberton, Pretoria.

The totally insufficient diagnosis given by Lefèvre of this and of the many closely allied species, in which no mention is made of the sexes, which differ so much in sculpturing, nor of other details, does not enable the student to determine with certainty the greater number of African species of *Colasposoma*, which are frequently only separated by small but evidently constant structural characters. Of *C. fulgidum* I possess a typical specimen named by Lefèvre, which agrees in the main points with his description; but the author was evidently not aware of the many colour-varieties which this species represents and which cannot be separated in any way from the type.

The latter is of bright cupreous colour above, with all the margins of the thorax and that of the elytra narrowly dark blue, the underside and legs of the latter colour entirely; but in the varieties, and they are the ones obtained by Mr. Distant, the colour above is either metallic green, dark cupreous, or blue; the legs and the antennæ in all specimens are dark or pale fulvous, and the underside more or less æneous and pubescent. These differences seem at first sight sufficient to consider them specifically distinct, but the same variations in coloration take place in nearly all other species of the genus, and the sculpturing shows no such difference; all the green-coloured individuals have the margins of the thorax and of the elytra narrowly cupreous, analogous to the blue margins of the typical form. The principal character of distinction, however, is to be found in the transverse rugosities of the elytra, which in both sexes occupy the entire disk nearly to the suture instead of the sides only, as is the case in many other species; the interstices and the thorax are distinctly and closely punctured, but not "subconfluent punctatus," as

Lefèvre says. The punctures, although closely placed, are everywhere separated.

Colasposoma scutellare, Lefèv. Zoutpansberg.

I refer a specimen of cupreous and another of metallic green upper surface to this species; Lefèvre's totally insufficient description applies equally well to dozens of other species, and no sex is mentioned. In my specimens the colour of the upper surface is rather opaque and silky; the thorax in the male insect is broad, with strongly rounded sides, finely and rather closely but irregularly punctured, in the green-coloured specimens narrowly margined with cupreous, like the sides and apex of the epistome; the scutellum is entirely of the latter colour; the elytra are very finely punctured indeed, except below the base, where there is a very feeble transverse depression, and of the same colour as the thorax, of silky appearance; the underside and legs are entirely cupreous: a variety is of opaque reddish-cupreous colour above and below. I also possess this species from Delagoa Bay. It remains, however, doubtful whether the determination is correct, although it fairly agrees with the description.

Colasposoma transvaalense, Jac. Pretoria.

Euryope megacephala, Thoms. Delagoa Bay.

Euryope terminalis, Baly. Pretoria.

Pseudocolaspis halyporphyrea, Marsh. Barberton.

A single specimen with dark blue elytra, the latter with a bright cupreous transverse basal band and a similarly coloured elongate patch below the middle, but agreeing in all other respects with the typical form.

Syagrus puncticollis, Lefèv. Pretoria.

Syagrus mashonanus, Jac. Zoutpansberg.

Menius Distanti, Jac. Pretoria and Waterberg.

Rhembastus variabilis, Har. Pretoria.

Mecistes seriatus, Lefèv. Zoutpansberg.

Corynodes compressicornis, Fabr. Barberton.

Rhembastus insignitus, sp. n.

Testaceous, the apical joints of the antennæ fuscous; head and thorax pale flavous, impunctate; elytra strongly punc-

tate-striate, the punctures distinct to the apex; femora with a small tooth.

Length 4 millim.

Head impunctate, the clypeus not separated from the face, finely punctured, its anterior margin concave; eyes surrounded by a very narrow sulcus; antennæ extending to the middle of the elytra, flavous, the last five joints fuscous, the second joint as long as the third but thicker, terminal joints slightly thickened; thorax nearly twice as broad as long, the sides rounded, the angles distinct, the surface entirely impunctate, flavous, shining; elytra wider at the base than the thorax, with a very slight depression below the base, strongly punctate-striate, the punctures distinct to the apex: the underside slightly darker, impunctate; the legs pale testaceous, the femora with a small tooth; prosternum slightly narrowed between the coxæ, impunctate.

Hab. Pretoria.

Separated from any of its allies by the entirely testaceous uniform coloration and by the impunctate head and thorax; the shape of this insect is less broad and the thorax less transverse than in many other species of this genus, notably *R. variabilis*, Har., but the structural characters are the same.

CHRY SOMELINÆ.

Chrysomela metallica, De Geer. Cape Colony: Grahamstown.

Chrysomela plagioderoides, Vogel (?). Cape Colony: Brak Kloof.

Atechna 20-maculata, Clark. Natal: Pine Town.

Atechna 20-pustulata, Thunb. Barberton.

Atechna confluens, Gerst. Waterberg.

Atechna fasciata, De Geer. Cape Colony: Grahamstown.

Centroscelis macularis, Clark. Cape Colony: Brak Kloof, Grahamstown.

Centroscelis notata, Fabr. Barberton.

Plagiodera cuprea, Baly. Pretoria.

Lina discolor. Pretoria.

Mesoplatys ochroptera, Stål. Pretoria, Nyassaland, Fort Johnston.

Many specimens.

HALTICINÆ.

Cladocera femoralis, Gerst. Rustenburg.

Halitica pyritosa, Erichs. Pretoria.

Chætocnema natalensis, Baly. Natal: Pine Town.

Edionychis natalensis, Baly. Barberton.

Decaria abdominalis, Jac. Barberton.

This Halticide is the second known genus possessing ten-jointed antennæ only; the specimens in this collection have the entire underside black; in the type from Mashonaland the abdomen is fulvous, but I cannot find any other distinctive characters.

Blepharida reticulata, Baly. Waterberg, Zoutpansberg, Pretoria.

A more strongly marked variety of this species has been described by myself as *B. Holubi*.

Blepharida ornata, Baly. Barberton.

Blepharida inornata, Jac. Barberton.

Eriotica fuscipennis, Har. Barberton.

Phygasia pallida, sp. n.

Entirely pale flavous; head and thorax impunctate, the latter with a shallow transverse sulcus; elytra finely and closely punctured.

Length $4\frac{1}{2}$ millim.

Head rather broad, impunctate, the frontal elevations broadly subquadrate, feebly raised; clypeus not strongly convex, rather broad, impunctate; palpi thickened; antennæ robust, flavous, not extending to the middle of the elytra, the second joint very short, rounded, the third rather longer than the fourth joint, all the others thickened, the terminal one elongate; thorax twice as broad as long, the sides strongly rounded at the middle, constricted at the base, anterior angles obtuse, posterior angles dentiform, the disk impunctate, shining, with a shallow sulcus near the base, bounded at the sides by a perpendicular obsolete groove; scutellum broad; elytra wider at the base than the thorax, finely and closely punctured: underside and legs flavous; prosternum extremely narrow; tibiæ mucronate; the first joint of the posterior tarsi as long as the following joints together.

Hab. Pretoria.

Chapuis has given a four-lined description of *Lactica africana* from Abyssinia (Annali di Mus. Civ. Genova, 1879), which probably belongs to *Phygasia*. This insect agrees in the main point with the present species, but is larger, and the antennæ and tarsi are more or less stained with fuscous; as no other details are given, which, in my opinion, is worse than no description at all, it is impossible to say whether the species described here is identical with that of Chapuis or not; but probably it is distinct, as several closely allied African species of the genus exist.

Phygasia limbata, Baly. Pretoria.

Podagrica indica, Fabr. Pretoria.

This apparently not uncommon species has been described by Fabricius from India, from which country I have seen no specimens as yet, although it is not impossible that the insect has this wide distribution, as the same is the case with *Cryptcephalus sanguinolentus*, Oliv. At all events, the species is not a *Sphæroderma*, where it is placed in Gemminger's Catalogue, but a true *Podagrica*, with which it agrees in structural characters and in the closed, not open, anterior coxal cavities.

GALEUCINÆ.

Aulacophora foveicollis, Küst. Nyassaland, Fort Johnston.

Aulacophora sexplagiata, Jac. Cape Colony: Port Alfred.

Hyperacantha abdominalis, Jac. Barberton.

Hyperacantha fenestrata, Chap. Barberton.

Hyperacantha pectoralis, Jac. (nec Fairmaire). Pretoria, Johannesburg, Waterberg.

Hyperacantha bituberculata, Fabr. Barberton.

Diacantha conifera, Fairm. Waterberg, Rustenburg.

Laetana histrio, Baly. Barberton.

Malacosoma (Sermyla) suturalis, Alld. Zoutpansberg.

Malacosoma bimaculata, Bert. Barberton.

Cerochroa brachialis, Stål. Rustenburg.

Galerucella triloba, Fabr. Pretoria.

Megalognatha ventricosa, Baly. Zoutpansberg.

Asbecesta cyanipennis, Har. Pretoria.

Malacosoma transvaalensis, sp. n.

Black, the head impunctate; thorax fulvous, extremely minutely punctured; elytra more strongly and closely punctate; legs black.

Length 4 millim.

Head black, impunctate, the frontal tubercles strongly raised, trigonate; the clypeus narrowly transverse, with a broad and highly raised central ridge; anterior edge of the labrum testaceous; antennæ short and robust, scarcely extending to the middle of the elytra, black, the second joint not much shorter than the third, which is very nearly as long as the fourth, all the joints somewhat triangularly thickened, the apical one more elongate; thorax subquadrate, the sides slightly constricted near the base, more rounded at the middle, the angles distinct, slightly tuberculiform, the surface with a few very minute punctures, pale fulvous; scutellum small, black; elytra much broader at the base than the thorax, much more distinctly although finely and closely punctured, of the same colour as the thorax, their epipleuræ broad, continued below the middle: underside and legs black.

Hab. Zoutpansberg.

Very closely allied to *M. capitatum*, Jac., but the entire underside and legs black, the antennæ of the latter colour and with shorter joints, the general size of the insect smaller; in the female the antennæ are shorter still and only reach to the base of the elytra.

Enidea imitans, sp. n.

Black, the femora and the tibiæ fulvous; head and thorax greenish, the latter deeply transversely sulcate, nearly impunctate; elytra finely punctured, flavous, the sutural and lateral margins metallic dark green.

Var.—The lower part of the face, the basal joints of the antennæ, the thorax, elytra, and legs flavous.

Mas.—Head deeply excavated below the antennæ; the base with a thorn-like projection.

Length 5 millim.

Mas.—Narrowly parallel, the head broad, greenish black, impunctate, the frontal tubercles strongly raised, triangular and pointed, divided by a deep longitudinal groove, the lower portion of the face thickened below the eyes, deeply excavated above the clypeus, the cavity furnished with some hairs and a tooth or thorn-like lamina at the upper portion; palpi thickened; eyes globular and rather large; antennæ long and slender, black, the first joint very robust, strongly

thickened and elongate, the second short, moniliform, the following joints elongate, nearly equal in length; thorax transverse, the sides narrowed near the base, widened anteriorly, the angles acute, the surface deeply transversely sulcate, minutely granulate, dark greenish, with a few punctures near the anterior angles; scutellum broad, blackish; elytra wider at the base than the thorax, very finely punctured, flavous; a sutural and lateral narrow band, not extending to the apex, dark green, their epipleuræ continued to the apex: underside black, shining; legs fulvous, the apex of the tibiæ and the tarsi fuscous; tibiæ unarmed, the first joint of the posterior tarsi as long as the following joints together; claws appendiculate; the anterior coxal cavities closed.

Hab. Barberton, Pretoria.

This species, which is the second representative in Africa of the genus, with which it seems to agree in every respect, bears a very strong resemblance in shape and coloration to the genus *Sardoidea*, Jac. (Trans. Ent. Soc. Lond. 1895), for which it might be easily mistaken, as the only difference of importance seems to be the state of the anterior coxal cavities, which in the present insect are closed, but open in *Sardoidea*; the male differs besides this in the deeply excavate lower portion of the head, frequently found in *Ænidea*, while the antennæ show minor differences in structure and colour; the female has a simple head and less thickened antennæ. The variety or aberration, of which many more specimens were obtained than of the form which I look upon as typical, at first sight seems to represent another species; in this variety the lower portion of the head, the greater number of the lower joints of the antennæ, the thorax, elytra, and legs are entirely flavous, but in a single specimen the elytra have the sutural and lateral stripes, thus showing its identity with the type, with which it has otherwise all structural details in common as well as the locality.

AGELACIDA, gen. nov.

Elongate; antennæ filiform; thorax transverse, without depressions; elytra irregularly punctured, their epipleuræ broad anteriorly, disappearing below the middle; tibiæ unarmed, not channelled, the first joint of the posterior tarsi as long as the following two joints together, claws appendiculate; prosternum extremely narrow and convex between the coxæ, the anterior cavities closed.

On account of the want of the elytral epipleuræ below the middle and the closed anterior coxal cavities, this genus will

enter the group *Monoleptinae*. It differs from any genera contained in it by the unarmed femora and the different shape of the thorax. The single species obtained bears some resemblance to the genus *Antipha*, Baly, with which it agrees in most structural characters, but not in the structure of the elytral epipleuræ.

Agelacida marginata, sp. n.

Black; head fulvous, with an æneous spot; thorax finely punctured, metallic green, the sides fulvous; elytra very finely and closely punctured and finely wrinkled, metallic green, the lateral margins narrowly and the apex broadly fulvous.

Length 7-8 millim.

Head broad, impunctate, fulvous, the vertex with an oblong greenish-æneous spot, the frontal elevations narrowly transverse, deeply grooved behind, the clypeus triangular, narrow; antennæ not extending to the middle of the elytra, black, nearly all the joints, with the exception of the second, of equal length, the intermediate joints slightly widened; thorax more than twice as broad as long, the anterior margin straight, its angles slightly tuberculiform, the sides very little rounded, the posterior angles obsolete, slightly oblique, the setiferous pore placed in front of the posterior margin, the surface very closely and finely punctured, with some larger punctures intermixed, the disk (in shape of a broad transverse patch) metallic green, the sides fulvous; an obsolete transverse depression is placed below the anterior margin; scutellum broad, black; elytra very closely and finely punctured, with finely wrinkled interstices, metallic green, the lateral margins and the apex more broadly fulvous: underside and legs black, finely pubescent.

Hab. Johannesburg, Pretoria.

Platyxantha scutellata, Jac. Pretoria.

Candezea flaveola, Gerst. Delagoa Bay.

Monolepta bioculata, Fabr. Cape Colony: Wynberg.

Monolepta intermedia, Rits. Johannesburg, Zoutpansberg.

Monolepta bifasciata, Fabr. Barberton, Durban.

Monolepta 8-maculata, Jac. Barberton.

Monolepta dichroa, Alld. Barberton, Durban.

Monolepta pauperata, Erichs. Natal: Maritzburg.

APPENDIX.

[The following species, not included in this list, were obtained during my first visit to the Transvaal (1890-91) and identified by Messrs Martin Jacoby and C. J. Gahan. They were enumerated in my 'Naturalist in the Transvaal,' and may, perhaps, properly be added here to bring the list of Transvaal Coleoptera up to date of present knowledge.—W. L. DISTANT.]

CRYPTOCEPHALINÆ.

- Gyandrophthalma anisogramma*, Lac., var. Pretoria.
Camptolenes cribraria, Lac. Pretoria.
Cryptocephalus pustulatus, Fabr. Pretoria.
 — *Dregei*, Boh. Pretoria.
 — *pardalis*, Suffr. Pretoria.
Melitonoma epistomata, Fabr. Pretoria.
Achenops facialis, Jacoby. Pretoria.

EUMOLPINÆ.

- Colasposoma pubescens*, Lefèv. Pretoria.
Pseudocolaspis sericata, Marsh. Pretoria.

CHRYSOMELINÆ.

- Chrysomela opulenta*, Reiche. Pretoria.
Polysticta Clarkii, Baly. Pretoria.
Podontia nigrotessellata, Baly. Pretoria.

GALERUCINÆ.

- Aulacophora vinula*, Erichs. Pretoria.
Hyperacantha oculata, Karsch. Pretoria.
Sphaeroderma indica, Fabr. Pretoria.
Ænidea pretoriae, Gahan. Pretoria.
Spilocephalus viridipennis, Jacoby. Pretoria.
Ootheca modesta, Gahan. Pretoria.

Transvaal Species in British Museum.

- Spilocephalus Distanti*, Gahan.

LVII.—*Description of a new Bat from Selangore.*

By OLDFIELD THOMAS.

THE British Museum owes to Mr. H. N. Ridley, formerly on its staff, and now Director of the Botanical Gardens at Singapore, a number of small mammals collected at different times on Singapore Island and the neighbouring parts of the

Malay Peninsula. Among the specimens so obtained may be specially mentioned examples of the rare *Cynopterus Lucasi*, Dobs., only hitherto recorded from Borneo, but of which Mr. Ridley has sent several specimens from Singapore Island. In the most recent consignment, obtained during an expedition to explore the caves of Selangore, besides specimens of *Rhinolophus affinis* and *minor*, there occur two examples of a *Pipistrelle* which appears to be new, and which may be called

Pipistrellus Ridleyi, sp. n.

Size about as in *P. abramus*, although the forearm is markedly shorter. Ears of medium length, narrow, their inner margin evenly but slightly convex, except just below the tip, where there is a slight concavity; tip narrowly rounded off; outer margin faintly concave above, convex below. Tragus fairly long, reaching its greatest breadth rather below the centre of its inner margin; inner margin straight or faintly concave, tip sharply pointed, outer margin evenly convex, with a distinct rounded basal lobule. Wings attached to the metatarsus, near the base of the toes. No adhesive disks on wrists or soles; hind feet large and clumsy; calcars long, reaching two thirds of the distance towards the tip of the tail; no postcalcarea lobules.

Fur almost restricted to the trunk, the arms, wings, and legs naked, but the toes well covered with hairs. Colour smoky brown above and below.

Skull, as compared with that of *P. abramus*, rather narrower, less flattened above, and with a narrower and more elongated muzzle. Bullæ smaller. Lower jaw not so thickened anteriorly.

Incisors quite different from those of other species; the inner one extremely short, scarcely longer than broad, its main cusp directed rather inwards than forwards, and not hiding the well-marked though low accessory cusp; outer incisor about equal in length to the main cusp of the inner incisor, and with a small accessory inner cusp, not visible from the outer side. Canines rather short, without accessory basal processes behind. Anterior premolar well-developed, standing in the tooth-row, and wholly visible from the side, owing to the unusual distance which separates the posterior premolar from the canine. Lower incisors in the direction of the jaw, the third longer (horizontally) and markedly thicker than the other two; lower canine very short and conical; anterior premolar not crowded out of the tooth-row, much shorter than in *P. abramus*.

Dimensions of the type (an adult male in spirit):—

Forearm 28 millim.

Head and body 38; tail 32; ear 11; tragus on inner edge 4·2; lower leg 13; calcar 12·5. Greatest length of skull 12·1.

Hab. Selangore, Malay Peninsula. "Caught under a railway-arch."

Type B.M. no. 98.3.13.5. Collected and presented by Mr. H. N. Ridley.

This little *Pipistrelle* is readily distinguishable from all others by its short and peculiarly-shaped incisors, for all the ordinary members of the genus have long styliform incisors, which may or may not have a small supplementary cusp near their tips, but which are never short, broad, and separated into two almost subequal cusps, as is the case in *P. Ridleyi*. The unusually short forearms, the wide space between the canines and posterior premolars, in the centre of which the small premolar stands, and the disproportionate size of the last lower incisor are also all points distinguishing *P. Ridleyi* from any other species known to me.

In some respects, notably in the shortness of the forearm, *P. Ridleyi* is approached by Temminck's "*Vespertilio tenuis*," of which no authentic specimens are in the Museum collection; but Dobson's description of the teeth of that animal, based on the types, shows conclusively that, whatever else it may be, it is not the little species discovered by Mr. Ridley.

LVIII.—On Three new Species of Hydroids and One new to Britain*. By C. C. NUTTING, Professor of Systematic Zoology in the University of Iowa.

[Plates XIV.–XVI.]

THE material upon which the following descriptions are based was obtained by me during April and May, 1895, whilst occupying a table at the Laboratory of the Marine Biological Association at Plymouth, the observations being made for the most part on the living animal.

Eudendrium album, sp. n. (Pl. XIV. fig. 1.)

Trophosome.—Colony minute for this genus, matured specimens measuring from $\frac{1}{4}$ to $\frac{3}{8}$ inch in height. Hydrocaulus

* Cf. 'Journal of the Marine Biological Association,' vol. iv.

irregularly and loosely branching, the branches being slender and giving rise to very long ultimate ramuli, which are often many times the length of the hydranths. Proximal branches with a series of distinct annulations above their origin; distal branches and ultimate ramuli with the annulations indistinct or wanting. *Hydranths white*, minute, with large trumpet-shaped proboscis and 26 to 32 tentacles.

Gonosome.—Male gonophores borne in bithalamic verticils below the bases of the tentacles of the hydranths; female gonophores arranged in a somewhat irregular monothalamic verticil in the same position. The hydranths bearing gonophores are not so generally aborted as in the case of *E. capillare*.

Colour.—Main stem and branches distinctly dark brown, fading to pale horn-colour and whitish in the ultimate ramuli. Hydranths white, with little, if any, brownish or pinkish tint to the body or proboscis, although the contents of the body-cavity may show through and impart an effect of faint coloration.

Habitat.—On stones in shallow water near Millbay Channel. The stones are often covered with a dense growth of this hydroid, which appears to the unaided eye like white cottony tufts or downy patches. The gonophores were abundant in April.

The distinguishing features of this species are the minuteness of the colony and of the individual hydranths, both of which are less than half the height of any other *Eudendrium* from British waters, and the very striking white colour of the hydranths—a feature not found in any other *Eudendrium* inhabiting those waters.

Opercularella hispida, sp. n. (Pl. XIV. fig. 2.)

Trophosome.—Hydrothecæ borne on very short pedicels springing from a creeping root-stalk, almost tubular, with slightly swelling sides, about three times as deep as wide. Margin divided into a number (10 to 12) of long slender teeth, whose points converge over the centre of the hydrotheca and form an operculum when the hydranth is retracted. Hydranth cylindrical, capable of great protrusion, with a conical proboscis and about 16 strongly serrated tentacles, the serrated appearance being due to very large nematocysts.

Gonosome not known.

Habitat.—Found growing over a stone, together with a colony of *Clava multicornis*.

Locality.—Plymouth, England.

This species bears some resemblance to *Calycella syringa*,

Linn., from which it differs in having a much shorter pedicel, a not strictly tubular hydrotheca, a greater number of segments to the operculum, in the absence of the tubular extension of the operculum, and in a much thinner structure, the hydrothecæ being of glassy transparency in *O. hispida*, but of a decided brownish or yellowish horn-colour in *O. syringa*. The most striking feature, however, of the present species is the remarkably hispid appearance of the tentacles, which appear to be made up of a series of triangular segments, on account of the formidable array of large nematocysts with which they are armed. Whilst examining the expanded tentacles with a $\frac{1}{8}$ objective I was so fortunate as to see these batteries of projectiles suddenly explode, sending out a perfect maze of barbed threads, which appeared to be larger and longer than those of any hydroid that I have seen except *Nematophorus grandis*, Clarke.

In the absence of the gonosome it is impossible to say with any certainty to which genus this interesting little species belongs. The general form of the hydrotheca, the cylindrical hydranth with conical proboscis, together with the convergent teeth, give a facies like that of the genus *Opercularella*, in which it is provisionally placed.

*Plumularia Alleni**, sp. n. (Pl. XV. figs. 1-6.)

Trophosome.—Colony attaining a height of $\frac{1}{2}$ to $\frac{3}{4}$ inch. Stem simple, monosiphonic, divided into regular internodes, each of which bears a hydrocladium on a process springing from near its distal end. Hydrocladia divided into alternating hydrothecate and intervening internodes, the former being the longer, with deep annulations occasionally appearing near the nodes. Hydrothecæ rather shallow, cup-shaped, borne near the distal ends of the internodes. Nematophores small, bithalamic; a supracalcine pair reaching just above the top of the hydrotheca, a mesial nematophore some distance below the hydrotheca, and another in the middle of each intervening internode; a pair of cauline nematophores in the axil of each hydrocladium and one just below the middle of each cauline internode on the side opposite the hydrocladium borne by that internode. Hydrothecæ with about 16 tentacles and a conical proboscis.

Gonosome.—Gonangia borne singly at the bases of the hydrocladia, of two kinds, one (female?) obconic, curved like a horn, narrowing rapidly to the very short pedicel. In

* Named after the Director of the Plymouth Laboratory, an enthusiastic worker in marine zoology.

several cases round bodies greatly resembling acrocysts were seen resting on the top of these gonangia. The other kind of gonangia (male?) was much longer, more slender, and but slightly curved. None of the gonangia were annulated.

Locality.—Plymouth Sound.

Habitat.—Found growing on *Antennularia ramosa*.

This delicate species bears considerable general resemblance in size, form, and parasitic habit to *P. halecioides*. It differs, however, in having a non-fascicled stem, smaller hydrothecæ, more numerous nematophores, and especially in the gonangia, which are greatly unlike the annulated structure of *P. halecioides*.

Aglaophenia Helleri, Marktanner-Turneretscher*.

(Pl. XVI. figs. 1-4.)

This species was collected by Mr. Allen on May 8th from beneath the overhanging shelf of rock below the remains of the old lighthouse at the Eddystone, where it was growing in considerable quantity †. This is the first record of *A. Helleri* on British shores.

Trophosome.—Colony unbranched, attaining a height of $\frac{3}{4}$ inch. Stem monosiphonic, divided by very deep nodes into short internodes, each bearing a hydrocladium springing from its antero-lateral aspect. Hydrocladia alternate, closely set, divided into internodes, each bearing a hydrotheca and partly divided by two imperfect transverse septa. Nodes very distinct. Hydrothecæ obconic, about as deep as the aperture is wide. Marginal teeth 9, unequal in size, the anterior one often being slightly incurved and rather longer and more pointed than the others; the second and fourth teeth counting from behind are larger than the first and third. There is no apparent intrathecal ridge. Supracalycine nematophores rather small, stout, reaching to the level of the hydrothecal margin; the mesial nematophore springs from just below the margin of the hydrotheca and projects straight upwards and outwards, its truncated end reaching to the level of the longest marginal teeth. There are two modified nematophores on each hydrocladium near its base.

Gonosome (description from Naples specimen).—Corbula thick and short, with the leaves or ribs more closely soldered together than in the other small British species. Ribs six on each side, with a row of nematophores on their distal edges.

* 'Die Hydroiden des k. k. naturhistorischen Hofmuseums,' Vienna, 1890, p. 271, pl. vii.

† 'Journal of the Marine Biological Association,' n. s. iv. p. 49.
Ann. & Mag. N. Hist. Ser. 7. Vol. i. 28

Habitat.—Found growing on thick roots of marine plants from Eddystone rocks.

Distribution.—Naples and Rovigno (*Marktanner-Turner-etscher*), and Plymouth, England.

EXPLANATION OF THE PLATES.

[The figures were made by Miss Mary MacBride from sketches by the author.]

PLATE XIV.

- Fig. 1. Eudendrium album.*
Fig. 2. Opercularella hispida.

PLATE XV.

- Fig. 1. Plumularia Alleni.* Part of colony with gonangia.
Fig. 2. Ditto. Hydrocladium, enlarged.
Fig. 3. Ditto. Hydrotheca and hydranth.
Fig. 4. Ditto. Gonangium (♀?).
Fig. 5. Ditto. Gonangium with apparent acrocyst.
Fig. 6. Ditto. Gonangium (♂?).

PLATE XVI.

- Fig. 1. Aglaophenia Helleri**. Two hydrothecæ and internodes.
Fig. 2. Ditto. Single hydrotheca, enlarged.
Fig. 3. Ditto. Expanded hydranth.
Fig. 4. Ditto. Corbula.

LIX.—*Coleoptera collected in the Transvaal.* By W. L. DISTANT.

LONGICORNIA.

DURING my sojourn in the Transvaal I made every effort to form a collection of these interesting beetles; but they abound more in numbers than in species on the high and little-wooded veld around Pretoria and Johannesburg, and are there principally floral members of the family Cerambycidæ. The warmer and better-wooded regions are more productive, as might be expected, but in the Transvaal I always found the capture of a Longicorn, beyond the usual predominant species, somewhat uncommon in collecting experience. Many species come to light, as does the fine *Prosphilus serricornis*, which, as in many other known species, emits a loud squeaking noise on

* The polyp and corbula of *Aglaophenia Helleri* have not before been figured.

being handled. The appearance of some species is extremely local and spasmodic. As an example I may mention that on my first visit I procured a single example of a new species—*Paroeme Gahani*. During a subsequent three years' collecting I never saw another specimen, till I found it one day literally swarming in an old lumber-room, which was also my last acquaintance with the species, and affords an illustration of the difficulty in learning much as to habits or time of appearance. *Alphitopola maculosa* is, in Barberton at least, destructive to the leaves of orange-trees, as I was informed by my friend Mr. Harrison, who spoke from experience. *Tithoes confinis*, the largest Prionid found in the Transvaal, is not altogether scarce at Rustenburg, and is found under the bark of decaying or dead trees. It varies immensely in size—my largest specimen (from Rustenburg) measures 80 millim., my smallest example (from Barberton) only attains a length of 34 millim.

By the aid of my collection I am able to enumerate 100 species as found in the Transvaal, and, as might be expected, many of the smaller ones appear to be undescribed. Through the assistance of the Rev. H. A. Junod I received from time to time 47 species collected in the neighbourhood of Delagoa Bay. The enumeration and description of these I have added as an appendix, for many of the species are common to the two regions, and more will no doubt be subsequently proved to be distributed over what—the eastern Transvaal and Mozambique—is practically one entomological fauna, especially so far as these beetles are concerned.

I have received the greatest assistance from Mr. J. C. Gahan in the preparation of this paper, particularly in the generic identifications. The description of *Pixodarus* of Prionidæ he also obligingly made at my request.

Where not otherwise designated, the captures were my own; several friends who visited other districts of the Transvaal helped my quest for Longicorns, and their aid is here gratefully acknowledged.

Fam. Prionidæ.

Cucosceles Lacordairei, Bates. Zoutpansberg (*Kæssner*), Pretoria.

Pixodarus pretorius, sp. n. Pretoria.

Tithoes confinis, Lap. Rustenburg (*W. Ayres*), Barberton (*Dr. P. Rendall*), Pretoria.

Macrotoma natala, Thoms. Barberton (*Dr. P. Rendall*), Lydenburg District (*Zutrzenka*).

— *palmata*, Fabr. Pienaars River (*Thomson*), Pretoria.

Mallodon Downesi, Hope. Barberton (*Dr. P. Rendall*).

PIXODARUS.

(Fairm. Ann. Soc. Ent. France, 1887, p. 325.)

"Mandibles short. Eyes widely separated from one another above, coarsely faceted, and rather deeply emarginate. Antennæ of the male reaching to a little beyond the apex of the elytra; first joint rather short and stout, third nearly twice as long as first and about one third longer than the fourth; fifth to tenth joints subequal in length, each slightly longer than the fourth; eleventh joint almost half as long again as the tenth.

"Prothorax transverse, armed on each side with five or more spines, abruptly and strongly narrowed to the base behind the posterior spine. Elytra rounded at the apex, epipleures broad at the shoulder. Metathoracic episterna parallel-sided, broadly truncate behind. Legs unarmed, except at the apices of the tibiæ, where each is furnished with two terminal spurs underneath, and with a small spine-like terminal process on the upperside.

"This genus, though not fitting well into any of the minor groups defined by Lacordaire, seems to come nearest the group Hoploderides, which is made up of the single genus *Hoploderes*, Serv." (J. C. Gahan.)

Pixodarus pretorius, sp. n.

Head, antennæ, pronotum, scutellum, body beneath, and legs black; elytra ferruginous.

Head rugose, very coarsely reticulate, front transversely sulcate; antennæ with the basal joint stout and coarsely punctate; remaining joints more finely and sparingly punctate, gradually becoming more slender, and, with the exception of the very short second and the apical joint, with their apices clavate. Pronotum transverse, wider than long, very coarsely punctate, roughly rugose and intricate, lateral margins laminately produced, prominently spined at anterior and posterior angles, between which are about three very small and obscure tubercles or spines; anterior margin finely and ochraceously pilose, with a prominent tuft of ochraceous hairs near the lateral angles. Scutellum convexly rounded, obscurely tessellate. Elytra very finely and thickly punctate and slightly scabrous; humeral angles rounded, apices rounded, lateral and sutural margins very narrowly black. Apices of the tibiæ and the whole of the tarsi beneath ochraceously pilose. Body beneath thickly and finely punctate and sparingly pilose; head beneath rugose.

Long. 35 millim.; max. lat. elytr. 15 millim.

Hab. Transvaal, Pretoria (*Distant*).

The description is that of a single male specimen.

Fam. Cerambycidae.

- Zamium incultum*, Pasc. Barberton (*Dr. P. Rendall*).
 — *procilium*, Pasc. ?
 — *bicolor*, sp. n. Pienaars River (*W. L. D.*), Barberton (*Dr. P. Rendall*).
Xystrocera globosa, Oliv. Pretoria, Pienaars River.
 — *marginalis*, Goldf. Barberton (*Dr. P. Rendall*), Rustenburg (*Ayres*), Pretoria, Pienaars River.
 — *erosa*, Pasc. = *juvenca*, Pasc. Pretoria.
Taurotagus Klugi, Lacord. Waterberg (*Wilde*), Pretoria.
Prospilus serricornis, Dalm. Lydenburg District (*Zutrzenka*), Pretoria.
Plocederus denticornis, Fabr. Barberton (*Dr. P. Rendall*).
Tupinolachnus Gyllenhali, Fähr. Pretoria, Pienaars River.
 — *furvus*, Fähr. Pretoria (*Donov*).
Pachydissus natalensis, White. Lydenburg District (*Zutrzenka*).
Hesperophanes amicus, White. Pienaars River, Pretoria.
 — *picicornis*, Fairm. Pretoria.
 — *bimaculatus*, Fabr. Barberton (*Dr. P. Rendall*), Pienaars River (*Thomsen*).
Ossibia fuscatum, Chev. Pretoria, Pienaars River.
Lygus apicalis, Fähr. Pienaars River (*Thomsen*), Waterberg (*Wilde*).
Eugoa Dalmanni, Fähr. Rustenburg (*Krantz*), Pretoria, Warm Baths—Waterberg.
Compsomera elegantissima, White. Lydenburg District (*Zutrzenka*), Pretoria.
Phyllocnema Guenzli, White. Pretoria.
 — *latipes*, De Geer. Rustenburg (*Krantz*), Pretoria.
 — *pretiosa*, Pering. Barberton (*Dr. P. Rendall*), Pretoria.
Callichroma (?) *cupreum*, Fähr. Waterberg (*Wilde*), Rustenburg (*Krantz*), Pienaars River.
Litopus dispar, Thoms. Barberton (*Dr. P. Rendall*), Pretoria.
Promeces clavicornis, Fabr. Barberton (*Dr. P. Rendall*).
 — *viridis*, Pasc. Pretoria, Waterberg.
Anubis Mellyi, White. Pretoria.
 — *scalaris*, Pasc. Rustenburg, Pretoria.
Hypocrites Dejeani, sp. n. Barberton (*Dr. P. Rendall*), Pretoria.
Paroeme Gahani, Dist. Pretoria.
Cullidium Krantzi, sp. n. Rustenburg (*Krantz*).
Olyanthus capensis, Lap. & Gory. Pretoria.
Plagionotulus cinereus, Jord. n. Near Pretoria.
Amphidesmus analis, Oliv. Pretoria.
Philagathes letus, Thoms. Pretoria.
Eleanor Dohrni, Fähr. Near Pretoria.

Zamium bicolor, sp. n.

Head and thorax fuscous; antennæ, elytra, abdomen, and legs castaneous.

Head sparsely and coarsely punctate, with a central sulcation extending to front—in one specimen terminating between the eyes; antennæ sparingly pilose, with the basal joint clavate, about the six apical joints ochraceously pubescent. Pronotum broader than long, lateral margins convexly

ampliated, lateral areas and margins ochraceously pilose, coarsely punctate, very slightly rugulose, disk sparingly levigate. Scutellum with a foveate impression. Elytra entire, humeral angles subprominent, apices convex, thickly ochraceously hirsute, thickly and coarsely punctate; each elytron with two longitudinal raised lines, sutural margins slightly prominent. Body beneath and legs sparingly pilose.

Long. 13–15 millim.

Hab. Transvaal, Pienaars River (*Distant*); Barberton (*Dr. P. Rendall*).

Hypocrites Dejeani, sp. n.

Hypocrites femoratus, Dejean, MS.

Cyaneous; antennæ and legs black, anterior and intermediate femora and about basal half of posterior femora croceous, apices of anterior and intermediate femora black.

Head coarsely punctate, with a narrow central sulcation in front. Antennæ shorter than the body; basal joint incrassate and clavate, second joint very short, six apical joints thickened and sordid. Pronotum longer than broad, thickly and coarsely punctate, lateral margins ampliated and obtusely angulated, anterior and posterior margins raised and prominent. Elytra very coarsely and thickly punctate, humeral angles prominent and subnodulose, lateral margins slightly concavely sinuate, apices convex. Anterior and intermediate femora clavately incrassate; posterior femora extending beyond apex of abdomen, with their apical halves moderately incrassate.

Long. 11–12 millim.

Hab. Transvaal, Pretoria (*Distant*), Barberton (*Dr. P. Rendall*).

Callidium Krantzi, sp. n.

Head and basal joint of antennæ luteous; antennæ, eyes, and two eye-like spots near anterior margin black; thorax dark orange-yellow; elytra black, basal and apical areas and a large central spot on each elytron stramineous; abdomen beneath and femora luteous; tibiæ and tarsi black.

Head large, subquadrate, about as long as broad, very finely and obscurely punctate, with a narrow central striation extending to front, the two black spots situate near antenniferous tubercles oblique, raised, and tessellate; antennæ a little longer than the body, basal joint much thickened, remaining joints longly pilose. Pronotum about as long as broad, ovate, lateral margins convex, lateral areas coarsely

punctate and rugulose. Scutellum sulcate, subangulate posteriorly. Elytra thickly and finely punctate and thickly and finely pilose, humeral angles subnodulose, concavely sinuate before middle, widened and rounded posteriorly. Femora and tibiæ pilose.

Long. 10 millim.

Hab. Transvaal, Rustenburg (*Krantz*).

The genus *Callidium* will serve to contain this species until further generic subdivision is made amongst other allied species. The species here described is allied to *C. depressum*, Klug.

Fam. Lamiidæ.

Phantasis gigantea, Guér. (?). Barberton (*Dr. P. Rendall*).

— sp. (?). Rustenburg (*Ayres*), Zoutpansberg (*Kæssner*).

Brimus Rendalli, sp. n. Barberton (*Dr. P. Rendall*).

Hepomidion stygicum, Thoms. Lydenburg District (*Zutrzenka*).

Lasiopezus marmoratus, Fabr. Pienaars River (*Thomsen*).

Prosopocera falcata, sp. n. Rustenburg (*Krantz*).

Alphitopola maculosa, Pasc. Barberton (*Dr. P. Rendall and J. R. Harrison*).

— *reticulata*, sp. n. Barberton (*Dr. P. Rendall*).

— *murrea*, sp. n. Rustenburg (*Krantz*).

— *lapidaria*, sp. n. Lydenburg District (*Zutrzenka*), Pretoria.

Anoplostetha luctator, Fabr. Pretoria. Pienaars River.

Timoreticus aspersa, Gahan. Barberton (*Dr. P. Rendall*).

— *Dejeani*, Gahan. Rustenburg (*Krantz*), Pienaars River.

— *armaticeps*, Pering. (?). Rustenburg (*Krantz*).

Tragocephala vittata, Fähr. Waterberg (*Wilde*), Pretoria.

Tragiscoschema Wahlbergi, Fähr. Pretoria.

Ceroplesis bicincta, Fabr. Pretoria.

— *militaris*, Gerst. Pretoria.

— *hottentotta*. Fabr. Zoutpansberg (*Kæssner*), Lydenburg District (*Zutrzenka*).

— *Thunbergi*, Fähr. Barberton.

Ceroplesis capensis, Linn., var. Pienaars River (*Thomsen*), Waterberg (*Wilde*), Pretoria.

— *quinquefasciata*, Fabr. Barberton (*Dr. P. Rendall*).

Pycnopsis brachyptera, Thoms. Rustenburg (*Ayres*), Lydenburg District (*Zutrzenka*), Pretoria, Pienaars River, Waterberg, Zoutpansberg.

Cochliopselaphus catherina, White. Pretoria.

Phryneta spinator, Fabr. Barberton (*Dr. P. Rendall*), Zoutpansberg (*Kæssner*), Pretoria.

Chreostes obesa, Westw. Rustenburg (*Krantz*), Waterberg (*Wilde*), Zoutpansberg (*Kæssner*).

— *c'nereola*, White. Middelburg (*Kæssner*).

Mollonia granulata, Dist. Pretoria.

Nemotragus helvolus, Westw. Pienaars River (*Thomsen*).

Psathyrus modestus, sp. n. Barberton (*Dr. P. Rendall*), Pienaars River (*Thomsen*).

— *lineatus*, sp. n. Pienaars River (*Thomsen*).

Eumimetes barbertoni, sp. n. Barberton (*Dr. P. Rendall*).

- Crossotus Klugii*, Dist. Rustenburg (*Krantz*), Pretoria.
 — *plumicornis*, Serv. Pienaars River (*Thomsen*), Rustenburg (*Krantz*).
 — *æthiops*, sp. n. Barberton (*Dr. P. Rendall*).
Dichostates Ayresi, sp. n. Rustenburg.
Tetradia fasciatocollis, Thoms. Pretoria.
Hecyrda terrea, Bertol. Pretoria, Rustenburg.
Alyattes rustenburgi, sp. n. Rustenburg.
Apomecyna binubila, Pasc. Pretoria.
Eunidia maculiventris, Thoms. Pienaars River.
 — *Thomseni*, sp. n. Pienaars River.
Syessita divisa, Pasc. Barberton (*Dr. P. Rendall*).
Thercladodes Kraussi, White. Waterberg (*Wilde*), Zoutpansberg (*Kæssner*).
Amblesithis insignis, sp. n. Barberton (*Dr. P. Rendall*).
*Amblesithidus plagiatu*s, Fähr. Rustenburg.
Apodarya pilosa, Pasc. Pretoria.
Hyllisia stenodeoides, Pasc. Pretoria.
 — *subvirgata*, Fairm. Pienaars River.
Tetraglenes pienaari, sp. n. Pienaars River.
Volumnia Westermanni, Thoms. Zoutpansberg (*Kæssner*), Pretoria, Barberton, Rustenburg.
Morægamus globiceps, Harold. Barberton (*Dr. P. Rendall*), Pretoria.
Oberea scutellaris, Gerst. Middelburg (*Kæssner*), Pretoria, Rustenburg.
 — *Kæssneri*, sp. n. Zoutpansberg (*Kæssner*), Pretoria.
Nitocris nigricornis, Oliv. Pretoria, Zoutpansberg.
Blepisanis Bohemani, Pasc. Pretoria, Rustenburg.
 — *porosa*, Pasc. Zoutpansberg (*Kæssner*).
 — *exilis*, Pasc., var. Pretoria.

Brimus Rendalli, sp. n.

Ochraceous, mottled with dark chocolate-brown; antennæ, body beneath, and legs dark chocolate-brown.

Head coarsely punctate, with a narrow central striation and profoundly sulcate between the antenniferous tubercles; antennæ about as long as the body, basal joint very robust and pilose. Pronotum broader than long, with a broad anterior collar, the lateral margins slightly amplified and armed with a strong robust spine on each side. Elytra somewhat gibbous, narrowed and deflexed posteriorly, apices rounded, four very strong tubercles at base—two on each elytron, one at humeral angle, and one between that and suture—very coarsely punctate on anterior area.

The dark brown shadings on pronotum tend in the direction of each lateral area, with anterior central scattered markings; on elytra they are small and scattered on anterior half, then almost form a wide transverse fascia, and two large irregular spots near apex.

Long. 16 millim.; max. lat. elytr. 8 millim.

Hab. Transvaal, Barberton (*Dr. P. Rendall*).

Prosopocera fulcata, sp. n.

Chocolate-brown, almost completely covered with dull greyish pubescence.

Head very short, foveately sulcate in front, a long, robust, slightly incurved spine on each antenniferous tubercle; antennæ considerably longer than the body, basal joint robust, gradually thickened to apex, third joint longer than first. Pronotum about as broad as long, with a broad anterior collar, the frontal margin of which is convexly rounded; behind this collar is a transverse central sulcation; disk strongly rugose, basal margin distinct, sinuate, and with a central transverse striation; a long robust spinous tubercle on each lateral margin. Elytra with the humeral angles very prominent and ornamented with small scattered tubercles; apices moderately rounded. Scutellum broad and rounded.

Long. 24 millim.

Hab. Transvaal, Rustenburg (*Krantz*).

The peculiar character of this species is to be found in the strong spines to the antenniferous tubercles, which will probably serve as the distinguishing points for a new genus. In all other respects it seems a true *Prosopocera*.

Alphitopola reticulata, sp. n.

Head, thorax, body beneath, and legs greyishly pubescent; the head and pronotum with five longitudinal black fasciæ—three discal and one on each lateral area—on the pronotum the two outer discal fasciæ have a short, transverse, inwardly directed continuation, and between the two outer fasciæ is a small black spot; mesosternum with a short lateral oblique black fascia. Elytra black, covered with large greyish pubescent spots.

Head broad, moderately convex, front with a narrow central striation; antennæ longer than the body, fuscous, basal half of fourth joint greyishly pubescent. Pronotum longer than broad, constricted posteriorly, transversely sulcate before the anterior and posterior margins. Elytra with the lateral margins subparallel, apices obliquely rounded.

Long. 13 millim.

Hab. Transvaal, Barberton (*Dr. P. Rendall*).

Alphitopola murrea, sp. n.

Fulvous; a broad central fascia, narrowed anteriorly, to pronotum; scutellum, a cordate spot beneath same, a long irregular fascia, constricted at middle, on each elytron, and

lateral margins to sternum and abdomen cretaceous; a small black spot near base of the elytral fasciæ.

Head with a distinct striation from base to apex of front; antennæ fulvous, greyishly pubescent, a little longer than the body. Pronotum about as broad as long, transversely sulcate near anterior and posterior margins, lateral margins moderately convex. Elytra with the humeral angles prominent and their area ornamented with coarse black punctures; beyond this area the elytra are narrowed, their apices obliquely rounded. A central fascia to sternum and the legs more or less greyishly pubescent.

Long. 17 millim.

Hab. Transvaal, Rustenburg (*Krantz*).

Alphitopola lupidaria, sp. n.

Fulvous; a central fascia to pronotum, narrowed anteriorly and posteriorly, two irregular elongate fasciæ to each elytron and lateral margins to sternum cretaceous; a black spot in the centre of the upper elytral fascia.

Head with a distinct striation from base to apex of front; antennæ fulvous, greyishly pubescent, a little longer than the body. Pronotum about as broad as long, transversely sulcated near anterior and posterior margins. Elytra with coarse brown punctures at base, humeral angles prominent, apices obliquely rounded. Abdomen beneath greyishly pubescent.

Long. 18-21 millim.

Hab. Transvaal, Pretoria (*Distant*), Lydenburg District (*Zutrzenka*).

Psathyrus modestus, sp. n.

Strongly pilose, head and pronotum castaneous; elytra dark ochraceous, irregularly streaked with castaneous.

Head thickly and coarsely punctate, deeply sulcate between the antenniferous tubercles; antennæ shorter than the body, very strongly pilose, basal joint coarsely punctate and rugulose, with a tubercle on outer margin a little before apex, second and third joints distinctly nodulose at apex. Pronotum a little longer than broad, coarsely punctate, rugulose. Elytra elongate, thickly punctate, margins subparallel, apices rounded, marked by apparently four very much broken fasciæ on each elytron—two discal, the others at suture and lateral margin. Body beneath castaneous, legs dark ochraceous.

Long. 15 millim.

Hab. Transvaal, Barberton (*Dr. P. Rendall*).

Psathyrus lineatus, sp. n.

Head and pronotum dark castaneous, thickly covered with greyish pubescence; elytra greyish pubescent, each elytron with three longitudinal pale castaneous fasciæ extending from base to apex.

Head triangular from eyes, with a slight central longitudinal ridge, sulcate between antenniferous tubercles; antennæ castaneous, longly pilose, longer than the body, basal joint very short and thickened. Pronotum longer than broad, lateral margins convexly deflexed, subparallel, a slight central dorsal ridge. Elytra very elongate, narrowed towards apex, apices subangulate. Abdomen beneath and legs dark castaneous, greyishly pubescent.

Long. 15 millim.

Hab. Transvaal, Pienaars River (*Thomsen*).

Eumimetes barbertoni, sp. n.

Dull brownish, more or less griseously pubescent.

Head very widely sulcate between antenniferous tubercles, front truncate; antennæ about as long as the body, second joint about one third the length of the first, fourth and succeeding joints with their bases griseous. Pronotum about as long or a little longer than broad, griseously pubescent, anterior half coarsely punctate, posterior half with three blunt obscure tubercles, lateral areas sparingly coarsely punctate. Elytra wide at humeral angles, narrowed to apices, which are obliquely rounded, coarsely punctate, especially on anterior half, three tufts or hairy tubercles on each elytron situate on posterior half, griseously pubescent, but much less so at apical area. Body beneath and legs griseously pubescent, with brown punctures.

Long. 11 millim.; lat. hum. angl. 5 millim.

Hab. Transvaal, Barberton (*Dr. P. Rendall*).

Crossotus æthiops, sp. n.

Dull greyish, base of elytra brownish, tomentose.

Head with three narrow blackish striæ, broad, short, front narrowly but deeply sulcate. Antennæ shorter than the body, robust, longly pilose beneath, apical joints sparingly pilose. Pronotum about as long as broad, armed with eight strong tubercles, of which four are discal, and two on each lateral margin, one of the last being long and spinous; thickly pubescent, strongly transversely sulcated before anterior and posterior margins. Elytra broad at base, the humeral

angles prominent, narrowing to apices, which are rounded, thickly pubescent, brownishly tomentose on basal area; a short blackish tuft or hairy tubercle on each elytron a little beyond middle. Body beneath and legs greyishly pubescent; legs mottled with brownish spots; abdominal segments fringed with ochraceous hairs.

Long. 16-18 millim.; lat. hum. angl. 8-9 millim.

Hab. Transvaal, Barberton (*Dr. P. Rendall*).

Dichostates Ayresi, sp. n.

Broad, griseous, pubescent, each elytron ornamented with three tufts or hairy tubercles at base, situate transversely, and two on disk, placed longitudinally.

Head broad, short, mottled with fuscous, thickly pubescent, with a central narrow striation, somewhat foveate at anterior margin; antennæ longer than the body, shortly pilose, third joint nearly equal in length to the first, apices of the joints fringed with pale hairs. Pronotum broad, pilose, mottled with brown; lateral margins oblique, much broader at base, basal angles produced into a prominent blunt tooth. Elytra broadest at base, narrowing to apices, which are rounded, thickly and coarsely punctate, the tufts ochraceous. Body beneath and legs griseous, pubescent, the last spotted with brownish.

Long. 10 millim.; lat. hum. angl. 7 millim.

Hab. Transvaal, Rustenburg (*Distant*).

Near *D. caffer*, Fähr., but differing by arrangement of tufts to elytra.

Alyattes rustenburgi, sp. n.

Griseous, rather thickly covered with brownish pubescence.

Head broad, with a central longitudinal striation and a transverse striation between the antenniferous tubercles; antennæ shorter than the body, castaneous, with pale ochraceous pubescence, basal joint very robust, third about twice as long as first. Pronotum long, subquadrate; lateral margins deflexed and moderately convexly rounded, anterior margin slightly convex and very prominent; two robust central tubercles on disk. Elytra with the humeral angles very prominent, beyond which the lateral margins are moderately concavely sinuate to about centre, when they are again amplified and obliquely rounded to apices; each elytron with a very large compressed tubercle at base, and with a long compressed tuberculous elevation beyond middle; between these tubercles and outer margin a raised tuberculous line;

ochraceously and fuscously pubescent, coarsely punctate on about anterior half.

Long. 7 millim.

Hab. Transvaal, Rustenburg.

Eunidea Thomseni, sp. n.

Very pale brown, greyishly tomentose, elytra spotted with greyish.

Head broad, its posterior area gibbous, transversely pilose between antenniferous tubercles; front longitudinally pilose, with a narrow central striation, greyishly pubescent behind eyes; antennæ a little longer than the body, basal joint long, gradually clavate, third only slightly longer than first, third and following joints mostly greyish pubescent, excepting their apices, which are brown. Pronotum subquadrate; lateral margins slightly constricted towards base, anterior and posterior margins raised, prominent, posterior margin preceded by a transverse striation; two broad greyish pubescent fasciæ on each lateral area. Scutellum greyishly pubescent. Elytra thickly punctate, broadly greyishly pubescent on each lateral margin; three or four small greyish spots on each elytron and a large spot near apex joining lateral fascia at suture; humeral angles prominent and furcate. Body beneath and legs greyish, pubescent.

Long. 10-13 millim.

Hab. Transvaal, Pienaars River (*Thomsen and Distant*).

Amblesthis insignis, sp. n.

Head brownish ochraceous, pubescent; two oblique fasciæ beneath eyes and a short narrow central fascia, black; antennæ about as long as the body, first and second joints pale castaneous, remaining joints brownish ochraceous, with their apices fuscous, their bases narrowly pale greyish; basal joint strongly thickened, first and third joints about equal in length. Pronotum considerably longer than broad, ochraceous, moderately pilose, indications of two pale tubercles on disk; lateral margins produced into a prominent tubercular spine, which, with their whole basal area, are pale stramineous; behind disk the surface is somewhat foveate. Scutellum ochraceous, elongate, its apex rounded, centrally sulcate, and black. Elytra ochraceous, mottled with fuscous, pilose, coarsely punctate, rugulose, the apex pale ochraceous, with a few inner and outer marginal black spots, and preceded by a broad black fascia interspersed with griseous pubescence. Body beneath and legs pale ochraceous and pilose.

Long. 10 millim.

Hab. Transvaal, Barberton (*Dr. P. Rendall*).

Tetraglenes pienaari, sp. n.

Brownish ochraceous, strongly pilose.

Head about as broad as long, coarsely punctate, with an arcuate, black, strongly punctate, and slightly raised fascia between the eyes; antennæ about as long as the body, very strongly pilose, basal joint incrassated, longer than the third. Pronotum long, pilose, with two dark central longitudinal fasciæ, between and beyond which the colour is ochraceously pubescent, extreme lateral margins dark castaneous; narrowed anteriorly and posteriorly, the lateral margins moderately convex. Scutellum small, ochraceous, centrally sulcate. Elytra strongly punctate and pilose, their apices narrowed and rounded; each elytron with a broad, central, longitudinal, castaneous fascia, which is much mottled with ochraceous pubescence. Body beneath thickly and palely pubescent; legs brownish ochraceous.

Long. 8 millim.

Hab. Transvaal, Pienaars River (*Distant*).

Oberea Kæssneri, sp. n.

Head and pronotum ochraceous; elytra luteous, their apices broadly cinereous; body beneath and legs cinereous.

Head about as broad as long, with a central incision; antennæ pilose, a little longer than the body, joints 1, 2, 3, 9, 10, 11 fuscous, remaining joints ochraceous, with their apices fuscous. Pronotum subquadrate, lateral margins convexly deflected. Scutellum small, cinereous. Elytra very coarsely punctate, pubescent, humeral angles prominent, apices somewhat obliquely truncate.

Long. 10-11 millim.

Hab. Transvaal, Pretoria (*Distant*), Zoutpansberg (*Kæssner*).

APPENDIX.

Longicornia from Delagou Bay.

Fam. Prionidæ.

Pixodarus nyassæ, Bates.

Macrotoma natala, Thoms.

Aulacopus (?) *mossambicus*, sp. n.

Pixodarus nyassæ, Bates.

Pixodarus nyassæ, Bates, Ent. Month. Mag. xiv. p. 272 (1878).

Head, antennæ, pronotum, scutellum, body beneath, and legs black, elytra ferruginous.

Head rugose, very coarsely reticulate, front transversely sulcate; antennæ with the basal joint stout and coarsely punctate, remaining joints more finely and sparingly punctate, gradually becoming more slender, and, with the exception of the very short second and the apical joint, with their apices clavate. Pronotum transverse, wider than long, very coarsely punctate, roughly rugose and intricate; lateral margins laminately produced, armed with five strong spines, which on the right-hand margin are less strongly produced, and where there is an additional small central spine, making six in all; anterior margin finely and ochraceously pilose, with a prominent tuft of ochraceous hairs near the lateral angles. Scutellum obtusely triangular, the margins coarsely punctate. Elytra very finely and thickly punctate and slightly scabrous; humeral angles rounded, apices rounded, lateral and sutural margins very narrowly black. Apices of the tibiæ and the whole of the tarsi beneath ochraceously pilose. Body beneath thickly and finely punctate and sparingly pilose; head beneath rugose.

Long. 30 millim.; max. lat. elytr. 13 millim.

Hab. Delagoa Bay.

A single male specimen. Very closely allied to *P. pretorius*, Dist., from the Transvaal, but differing by the strongly spined lateral margins of the pronotum and the more triangulated scutellum.

Aulacopus (?) *mossambicus*, sp. n.

Dull reddish; abdomen beneath, scutellum, and eyes piceous.

Head coarsely punctate and rugulose, with a central linear levigate impression, the front transversely sulcate; antennæ about as long as the body, somewhat coarsely punctate, basal joint stout and clavate, second joint very short, its apical margin gibbous, third joint about twice as long as first. Pronotum transverse, wider than long, coarsely punctate and rugulose, lateral margins obtusely serrated, widened posteriorly, lateral posterior angles prominent. Scutellum coarsely punctate and rounded. Elytra slightly widened posteriorly, slightly sinuate before middle, apices obliquely rounded and overlapping; each elytron with seven raised longitudinal lines.

Long. 15 millim.

Hab. Delagoa Bay.

The head and pronotum are much duller red than the antennæ and elytra.

Fam. Cerambycidæ.

Xystrocera marginalis, Goldf.

Ploceoderus hamifer, Bates.

Cordylomera Schönherri, Fähr.

— *principalis*, sp. n.

Eugoa Dalmanni, Fähr.

Compsomera elegantissima, White.

Callichroma auricollæ, Thoms.

— *melaniâthæ*, White.

Philematium natalense, Bates.

Oxyprosopus Junodi, sp. n.

Eugenius plumatus, Fähr.

Promeces sp. (?) (Two imperfect specimens of an apparently undescribed species.)

Promecidus chalybeatus, White.

Anubis scalaris, Pasc.

Hypocrites tenuis, Bates.

Closteromerus sexpunctatus, Fabr.

Helymæus albicornis, sp. n.

Calanthemis myops, Thoms.

Apogaster mahota, sp. n.

Cordylomera principalis, sp. n.

Antennæ, body beneath, and legs ochraceous; head, pronotum, scutellum, and clavate apices of the femora castaneous; eyes black; elytra violaceous.

Head with the front transversely sulcate; antennæ with the basal joint strongly clavate. Pronotum much longer than broad, lateral margins slightly emarginate, subangularly amplified a little behind middle; posterior margin raised and prominent, surface very coarsely punctate and finely tessellate. Scutellum concavely sulcate. Elytra not reaching apex of abdomen, their apices emarginate and obtusely angulate; surface very coarsely punctate and tessellate, each elytron with two raised longitudinal lines.

Long. 15 millim.

Hab. Delagoa Bay.

Oxyprosopus Junodi, sp. n.

Body above and beneath cyaneous; legs pale castaneous, bases and apices of femora, the tibiæ, and antennæ black; tarsi fulvous.

Head sparingly and coarsely punctate, strongly foveate at base of antennæ and inner margin of eyes; anterior margin strongly incrassated, front with a longitudinal striation. Pronotum coarsely punctate, much longer than broad, lateral margins convexly amplified behind middle; two distinct foveæ transversely situate on disk. Scutellum concavely

sulcate. Elytra entire, thickly and somewhat finely punctate; humeral angles prominent and subnodulose; lateral margins slightly concave towards middle, narrowed towards apices. Posterior tibiæ inwardly bispinous at apices; anterior and intermediate femora coarsely punctate, posterior femora finely and sparingly punctate.

Long. 20 millim.

Hab. Delagoa Bay.

Helymæus albicornis, sp. n.

Helymæus cyanipennis, MS., Dej. (nom. præocc. by Thomson).

Black; elytra cyaneous, in one specimen olivaceous; pronotal angles cretaceous.

Head, including front, coarsely punctate and subrugulose, anterior margin strongly incrassated; antennæ with the basal joint incrassated and coarsely punctate. Pronotum about as broad as long, very thickly and coarsely punctate and tessellate, lateral margins amplified, obtusely angulate, and cretaceously hirsute. Scutellum triangular and sulcate. Elytra very thickly and coarsely punctate, the humeral angles subnodulose, lateral margins slightly concavely sinuate, apices truncate. Lateral margins of pro-, meso-, and metanotum, and margins of abdomen beneath cretaceously hirsute. Femora apically clavate, posterior femora extending a little beyond apex of abdomen.

Long. 13-15 millim.

Hab. Delagoa Bay.

The markings of the pronotum resemble those of the species described and figured by Gerstaecker under the name of *Closteromerus insignis*.

Apiogaster mahota, sp. n.

Black; clavate portion of anterior femora and rather more than basal half of elytra orange-yellow.

Head coarsely punctate and scabrous; antennæ shorter than the body, joints 1 to 4 coarsely punctate, remaining joints tomentose. Pronotum much longer than broad, rugnolose, constricted anteriorly. Elytra very coarsely and thickly punctate, their bases narrowly convex, levigate and subnodulose, lateral margins moderately concavely sinuate, apices angulate; each elytron with a prominent raised longitudinal line. Sternum very coarsely punctate; body beneath very finely pilose.

Long. 10 millim.

Hab. Delagoa Bay.

Fam. Lamiidæ.

- Anthores leuconotus*, Pasc.
Coptops fusca, Oliv.
Lasiopepus longimanus, Thoms., = *Whitei*, Pasc.
 — *marmoratus*, Fabr.
Alphitopola sofala, sp. n.
Timoreticus aspersa, Gahan.
Zographus aylicus, Bertol.
Tragocephala variegata, Bertol.
 — *Chevolati*, White.
 — *mashenga*, sp. n.
Rhaphidopsis melaleuca, Gerst.
Tragoscotema amicta, sp. n.
Ceroplesis militaris, Gerst.
 — *quinguefasciata*, Fabr.
Pycnopsis brachyptera, Thoms.
Cymatura bifasciata, Gerst.
Olenecamptus tessellata, sp. n.
Crossotus æthiops, Dist.
Dichostates concretus, Pasc.
Hercyrida terrea, Bertol.
Eunidia sp. (?).
Apheniastus bella, Dalm.
Volumnia Westermanni, Thoms.
Nitocris nigricornis, Oliv.
Blepisanis exilis, Pasc., var.

Alphitopola sofala, sp. n.

Head and pronotum pale ochraceous, with five longitudinal cinereous fasciæ—three discal and one on each lateral area—which on the pronotum are more or less united at about centre. Elytra ochraceous, with broad reticulate cinereous markings, enclosing ochraceous spots. Body beneath and legs cinereous, sternal and abdominal margins spotted or streaked with ochraceous.

Head with a distinct central striation in front; antennæ very much longer than the body, pale cinereous, becoming fuscous towards apices, basal joint thickened and wholly pale cinereous, third joint very long, twice as long as first, fourth a little shorter than third. Pronotum rather longer than broad, constricted posteriorly, transversely sulcate before anterior and posterior margins, lateral margins moderately convex. Elytra pubescent, coarsely and sparingly punctate, humeral angles prominent, apices obliquely rounded.

Long. 10 millim.

Hab. Delagoa Bay.

Tragocephala mashenga, sp. n.

Densely covered with a short ochraceous pubescence, and

with the following black markings, all edged with yellowish white, viz.:—head with the frontal margin, continued between antenniferous tubercles, and a central longitudinal fascia; pronotum with a broad central fascia, a little convex at centre and then concavely sinuate; elytra with three transverse fasciæ, the first on basal margin, the second at about centre, both connected along the suture, third fascia a little before apex, broad and reticulate, enclosing two ochraceous spots, and continued to near apex along the suture. Antennæ black; legs broadly streaked with griseous; a lateral black stripe on sternum from behind eyes; central sternal area, basal lateral margins of abdomen, coxæ, and trochanters griseous. Abdominal segmental margins, widened laterally and centrally, black, margined with yellowish white.

Head with a central narrow striation; antennæ much shorter than the body. Pronotum longer than broad, moderately rugulose, with a wide anterior collar, at the posterior margin of which is a transverse sulcation; a long, robust, spinous tubercle on each lateral margin, constricted at base. Scutellum black, its centre yellowish white, pubescent, subtriangular, apex obliquely rounded. Elytra with the humeral angles somewhat prominent.

Long. 23 millim.

Hab. Delagoa Bay.

Tragiscoschema amicta, sp. n.

Sulphureous, with black and griseous markings.

Head with a fine narrow central striation; the anterior and lateral margins, a narrow fascia extending from eyes to base, and a broad central triangular fascia, black; antennæ a little longer than the body, griseously pubescent. Pronotum longer than broad, the lateral areas depressed and rounded, a small tubercle on lateral margins, anterior margin convexly rounded, transversely sulcated near anterior and posterior margins, and with a broad central black fascia with griseous tints, the margins of which are moderately sinuate and angulate. Scutellum black, rounded. Elytra with a broad and much waved black fascia, griseous internally, extending from base to apex along the suture, and emitting three waved and angulated transverse fasciæ, one at base enclosing two rounded yellow spots, second a little beyond middle, third occupying apex and enclosing two rounded yellow spots; humeral angles somewhat oblique, apices obliquely rounded. Body beneath dark griseous, with a marginal series of

yellow spots to both sternum and abdomen; legs pale reddish brown.

Long. 12 millim.

Hab. Delagoa Bay.

Olenecamptus tessellata, sp. n.

Ferruginous, marked and spotted with cretaceous.

Head long, with a distinct central striation; a prominent marginal ridge between antenniferous tubercles, with a narrow central and two broad lateral cretaceous fasciæ, all united in front; antennæ much longer than the body, basal joint robust and very coarsely punctate, third joint more than three times as long as the first, apex of fourth joint and the whole of remaining joints darker brown. Pronotum longer than broad, transversely striate, constricted posteriorly, profoundly sulcate before anterior and posterior margins, with a broad cretaceous fascia on each lateral margin. Scutellum subquadrate, impunctate. Elytra densely and coarsely punctate; each elytron ornamented with four large, irregularly-shaped, cretaceous pubescent spots—one at base, second longest, about middle, third deeply notched, fourth smallest, near apex; humeral angles subprominent, lateral margins slightly concavely sinuate, apices very obliquely rounded. Body beneath griseously pubescent.

Long. 13 millim.

Hab. Delagoa Bay.

LX.—*Descriptions of some new Scorpions from Central and South America.* By R. I. POCKOCK.

THE species from Central America recorded in this paper will be redescribed and fully figured in the 'Biologia Centrali-Americana.'

Family Buthidæ.

Genus TITYUS, C. Koch.

Tityus Championi, sp. n.

♀.—*Colour* yellow, indistinctly variegated with black; mandibles and frontal portion of carapace, as well as its lateral margin, infusate; tergites indistinctly mottled, blackish laterally, with a bright yellow posterior spot, in addition to this spot there are four similar spots on each side of the middle line; posterior median portion of tergites with

a broad fuscous patch relieved by the pale keel and a pair of yellow spots; sterna rather thickly clouded with fuscous; lower side of tail clouded with fuscous, more thickly at the posterior end, the lower side of the fifth segment being mostly black; sides of tail also clouded with black, vesicle almost wholly infusate, aculeus pale; chelæ and legs mostly yellowish red, indistinctly mottled, digits black, with flavous tips; coxæ of legs pale. Upperside of *trunk* weakly granular in the intercarinal spaces; lower side of abdomen coriaceous, with a smooth triangular area in the middle of the third sternite, the fifth sternite with the keels finely granular, the external ones very short. *Tail* about six times as long as the carapace, which is a little shorter than its fifth segment, its fourth segment a little more than twice as long as wide (6·2 : 3); vesicle slightly wider than brachium, about as wide as hand; the intercarinal spaces finely granular; median lateral keel represented by a few posterior granules; the normal keels strong and coarsely granular, the superior subdenticulate and ending posteriorly in an elongated denticle, those on the fifth strongly granular; vesicle strongly granular; the tooth large, with conspicuous accessory denticle.

Chelæ of medium length, keels and granulation normal, hand only very slightly thicker than brachium, narrow, weakly keeled, the keels subgranular; digits in contact, weakly lobate and sinuate at the base, the movable about twice as long as the hand-back, furnished with 15 rows of teeth.

Pectinal teeth 18; no lobate expansion at the base of the shaft.

Measurements in millimetres.—Total length 62; length of carapace 6·5, of tail 39; width of the first segment 3·5, of the fifth 3, length of latter 7; width of vesicle 2·6, of brachium 2·3, of hand 2·5; length of hand-back 4·5, of movable digit 9.

Loc. Bugaba in Panama (*G. C. Champion*).

I am doubtful as to the sex of this specimen. The shortness and slenderness of the tail, coupled with slender unmodified chelæ, are evidence of its being a female. If this be the case, the absence of the pectinal lobe removes the species from the vicinity of the so-called *americanus* section of the genus, and points to relationship between it and the Brazilian species *stigmurus*, *bahiensis*, and *rufofuscus*, especially *stigmurus*. But from these it differs in having the caudal crests stronger and more strongly denticulated, especially the superior.

Genus CENTRURUS, Hempr. & Ehrenb.

Centrurus barbudensis, sp. n.

♀.—*Colour*. Trunk banded as in *C. insulanus* of Thorell, from Jamaica; legs, palpi, and lower surface of tail thickly spotted with black.

More coarsely granular than *insulanus*, but with the vesicle neither so wide, so high, nor the aculeus so curved. *Hand* broader, its width nearly half the length of the movable digit, with its inner surface rather coarsely granular.

Pectinal teeth 21.

♂.—More different from the male of *insulanus* than is the female, the tail being very long, about eight times the length of the carapace, which is shorter than its first segment; vesicle long and piriform.

In *insulanus* the tail is less than seven times the length of the carapace, which is longer than its first segment; the vesicle is subspherical.

Pectinal teeth 23.

Measurements in millimetres.—♀. Total length 59, carapace 6, tail 38·5; width of hand 3; length of movable digit 7·5 (in a female of *insulanus* the digit measures 7·5 and the width of the hand 2·5). ♂. Total length 68, of carapace 5·5, of tail 47.

Loc. Barbuda and Bird's Island (*W. R. Forrest coll.*).

Centrurus ochraceus, sp. n.

♀.—*Colour* a uniform ochre-brown on the upperside of the trunk (the very edges of the tergites alone infuscate); palpi and tail a uniform ochre-yellow; legs paler yellow.

Trunk less coarsely and less closely granular than in *R. margaritatus*; keels on tail and last abdominal sternite as in *margaritatus*, but less strongly granular, those on the sternite quite smooth; spine beneath aculeus of vesicle large, broader at base than in *margaritatus*; chelæ carinate as in the latter; the external finger-keel complete, but, like the middle finger-keel, smooth; eight rows of teeth on the movable digit.

♂.—Differing from the male of *margaritatus* in the same characters as the female from the female of *margaritatus*, but further recognizable by the different form of the vesicle, which, when viewed from below, is evenly oval and not broad, and strongly shouldered at the base of the aculeus.

Pectinal teeth, ♀ 27; ♂ 27–28.

Measurements in millimetres.—♀. Total length 72, carapace 7·2, tail 42. ♂. Total length 67, carapace 6, tail 43.

Loc. Yucatan (in Keyserling's coll.).

Centrurus nigrovariatus, sp. n.

♂. Allied to *C. infamatus* of C. Koch in colour and most structural features, but differing in the formation of the posterior segments of the tail, the fifth segment being wider than the first, with its upper surface much elevated in the middle, with a deep median groove expanding posteriorly into an oval depression.

Measurements in millimetres.—Total length 52, carapace 4·5, tail 33, width of its first segment 2·3, of its fifth 2·7, height of latter 2·5.

Loc. Oaxaca, Mexico.

Centrurus flavopictus, sp. n.

Colour reddish or brownish black, with a narrow median dorsal yellow stripe on the tergites, and a yellow spot on the posterior angle; tail reddish brown, darker beneath and posteriorly, vesicle red; humerus and brachium of chelæ blackish red, the trochanter and hand clear yellowish red, digits black, with distal third pale reddish; legs entirely yellow, mandibles infuscate distally.

External finger-keel of hand nearly obsolete, internal granular; eight rows of teeth on digit.

Pectinal teeth 22 (♂ ♀).

Measurements in millimetres.—♀. Total length 62, tail 37, carapace 6·7; width of hand and brachium 2·5, movable digit 7·5. ♂. Total length 69; length of tail 46, of carapace 7; width of hand 3·3, of brachium 2·5, length of finger 8.

Loc. Jalapa in Mexico.

Centrurus limbatus, sp. n.

♂.—Allied to *C. gracilis*, but strikingly different in colour as well as in some structural features. Carapace and tergites yellow or reddish, narrowly margined with black; ocular tubercle black; tail also yellow, with its fifth segment and vesicle uniformly brown or black; keels spotted black, especially those on the lower side of the segments; legs entirely pale yellow; palpi also pale yellow, digits quite black with reddish tips; mandibles distally infuscate.

Nine rows of teeth on the digits.

Pectinal teeth 25.

Measurements in millimetres.—Total length 100; length of carapace 9, of tail 70; width of hand 4, of brachium 3, length of movable digit 11.5.

Loc. Sirires, Talamanca (*H. Pittier coll.*).

Centrurus bicolor, sp. n.

♀.—*Colour* of trunk a brownish black above; sterna ochreyellow, mesially and marginally infuscate; first four segments of tail yellow above and at the sides, tinted with fuscous below, the keels black; fifth segment, vesicle, and lower surface of fourth infuscate; mandibles infuscate; chelæ yellow, with the exception of a fuscous spot at the apex of the brachium; hands reddish black, with black keel, fingers black with reddish tips; legs entirely rich yellow, the maxillary processes of chelæ and anterior legs infuscate; pectines pale.

Carapace sparsely granular as in *rubricauda*. Tail almost as in the latter, but the crests more numerously granular, there being upwards of 25 granules on the infero-lateral crest of the third segment; sterna 2–4 coriaceous and punctured, the fourth distinctly rugose and granular. Crests on hand strong.

Pectinal teeth 26–28.

♂.—Like female in colour, and differing structurally in the ordinary characters; sterna not granular.

Pectinal teeth 28–29.

Measurements in millimetres.—♀. Total length 109; length of carapace 10, of tail 63. ♂. Total length 120; length of carapace 11, of tail 82.

Loc. ♀. Poyo azul de Pirris (Atlantic) (*T. Zeledon coll.*).

♂. Santo Domingo de Golfo Dulce (*H. Pittier*).

Centrurus nigrimanus, sp. n.

♂.—Resembling *C. bicolor* in colour, but more closely and coarsely granular above; the fifth caudal segment having its crests distinctly granular, and also the inferior and lateral surfaces; the vesicle on the other hand, instead of being granular, is smooth below, and the tooth is much closer to the aculeus; the infero-lateral crests of the third caudal segment are furnished with about 30 granules.

Pectinal teeth 32–33.

Loc. Oaxaca (type) (68.74): also a younger specimen of apparently the same species from Honduras (*Indo-Colonial Exhibition*).

Centrurus rubricauda, sp. n.

♀.—*Colour* almost a uniform reddish black all over; the hands redder than the rest of the chelæ; tarsi and pectines yellow; tail reddish ochre-brown. Granular crests on hand evident and finely granular; crests on tail rather coarsely granular, but the *granules few in number* and more spaced than in allied forms; on the infero-lateral keel of the third segment, for example, the granules are fewer than twenty (15–19); vesicle granular; the spine not close up to the aculeus. *Sterna* 2–4 smooth, punctured, especially number 3.

Pectinal teeth 20–21.

♂.—Differing from the female in the normal sexual features, but in addition with the legs bright yellow; crests on hand scarcely perceptible; crest on tail weakly and sparsely granular as in female; vesicle parallel-sided when viewed from below, bulging on each side at right angles at the base of the aculeus.

Pectinal teeth 21–23.

Measurements in millimetres.—♀. Total length 80; length of carapace 8.5, of tail 51. ♂. Total length 103; length of carapace 9, of tail 71.

Loc. Managua in Costa Rica (*Dr. Rothschild*). Four male and four female specimens.

Centrurus nigrescens, sp. n.

♀.—*Colour* a uniform blackish green; tarsi and distal half of fingers ferruginous; pectines flavous; coxæ and sternal areas mesially ochraceous. Coarsely and thickly granular; middle finger-keel or hand strong, all the crests on the tail strongly granular; vesicle weakly granular; the spine close up to the base of the vesicle.

Pectinal teeth 25–27.

♂.—Like female in colour. Inferior crests on fifth caudal segment distinct and granular; vesicle about twice as long as wide, almost smooth, its shoulders not very strongly expanded.

Pectinal teeth 28–30.

Measurements in millimetres.—♀. Total length 89, of carapace 9, of tail 53.5. ♂. Total length 105, carapace 9, tail 73.

Loc. Xantipu (5500 feet alt.) (type); also Amula and Orizaba.

In colouring the female of this species resembles that of *rubricauda*, except that the reddish tint upon the palpi and

tail of the latter is not noticeable. But the granulation of the carapace is much closer, the interstices between the series of larger granules being filled in with fine granules, and the crests on the tail much more numerous granular, there being about 35 granules on the infero-lateral crest of the third segment; lastly, the spine is much closer to the base of the aculeus.

Centrurus fulvipes, sp. n.

♀.—Apparently differing from *nigrescens* only in colour, the humerus of the palp and the entire legs being a clear reddish yellow, also the basal segments of the tail reddish brown above. Spine on vesicle as in *nigrescens*, close to base of aculeus.

Pectinal teeth 28–29.

Loc. Xantipu in Mexico.

Family Scorpionidæ.

Genus DIPLOCENTRUS, Pet.

Diplocentrus rectimanus, sp. n.

Differing from the male of *Whitei* in the characters pointed out in the annexed table of species.

Measurements in millimetres.—Total length 55; length of carapace 6, of tail 30; width of hand 5·5; length of movable digit 7.

Loc. Jalapa (Mexico).

Diplocentrus politus, sp. n.

The essential characters of this species are set forth in the subjoined synoptical table. *Colour* yellowish brown. Upper-side of trunk smooth and polished; carapace granular laterally and with a few granules on the frontal lobes; tergites with a few scattered granules posteriorly and laterally; the last more coarsely granular. *Tail* robust, with intercarinal spaces smooth, the normal keels coarsely granular; the median lateral and inferior medians represented by a few granules on the fourth segment; median keel on fifth weak; sides of these segments with a few coarse granules; vesicle granular. *Chelæ* robust; humerus with irregular coarse granulation above, not distinctly keeled, smooth behind and below; brachium almost wholly smooth, a little granular in front above; hand smooth above, marked with scattered punctures, its inner edge and

lower surface towards the base of the immovable digit granular. *Legs* smooth.

Pectinal teeth 7.

Length 36 millim., of carapace 4.5, of tail 18.5.

Loc. Brazil. Three female examples in the Museum Collection.

The species of this genus known to me may be distinguished as follows :—

- a. Lateral margin of distal extremity of tarsus lobate, its inferior angle rounded, the terminal spine elevated above the level of the rest, forming a curved series.
 - a¹. Immovable digit of hand normally curved, inner border of hand more strongly produced; sculpturing of hand a reticulated pattern of ridges; upper surface of humerus flat, with strong anterior keel; frontal lobes not coarsely granular; tergites with a few large coarse granules amongst the fine granulation; lateral margins of caudal segments straight or nearly so; infero-lateral caudal crests not strongly converging; pectinal teeth 12-14 *Whitei*, Ger., ♂.
 - b¹. Immovable digit much straighter, inner edge of hand less strongly produced; sculpturing of hand more granular; area at base of digits distinctly granular; upperside of humerus convex, with weak anterior crest; frontal lobes coarsely granular; tergites without distinct coarse granules, but very rough with fine close-set granulation; caudal segments with rounded convex sides; infero-lateral caudal crests strongly converging posteriorly; pectinal teeth 10 *rectimanus*, sp. n., ♂.
- b. Lateral margin of distal extremity of the tarsus nearly straight, the lower angle squared or acute, the terminal spine in the same straight line with the rest (♂ ♀).
 - a². Caudal segments with relatively weak keels, the median inferior keels obsolete on the third and fourth segments, strong but not granular upon the first and second, median lateral keel weak, though just visible upon the second, third, and fourth segments; vesicle not granular; cuticle of trunk, legs, chelæ, and tail densely and finely punctured, less closely so on the sterna and coxæ; five spines on each side of the posterior tarsi *antillanus*, Poc., ♀.
 - b². Caudal segments strongly keeled, the inferior four keels strong and granular upon the first, second, and third segments, traceable by granules on the fourth, median lateral keel strong on the first and second segments and visible on the third; vesicle granular.

- a*³. Upperside of trunk, intercarinal spaces of tail, and outer surface of legs densely and closely granular; hands finely and closely punctured, furnished with one keel; 5-6 spines on posterior tarsi *scaber*, Poc., ♀.
- b*³. Upperside of trunk, intercarinal spaces of tail, and outer side of legs not closely granular, nor finely punctured as in *antillanus*, but smooth, polished, and beset with a few larger scattered granules; hands not closely and finely punctured as in *scaber* and *antillanus*; hands not keeled; 6-7 spines on posterior tarsi *politus*, sp. n.

The following brief criticisms may be made respecting Prof. Kraepelin's determinations of the species of this genus:—

Diplocentrus Hasethi, Kraepelin (Jahrb. Hamb. Wiss. Anst. xiii. p. 130, 1896), from Curaçao, is closely allied to *D. antillanus*, Poc., not to *D. Whitei*, Gervais; but, judging from the description, it differs in having the vesicle granular and the caudal keels better developed.

Diplocentrus Whitei, Kraepelin (Jahrb. Hamb. Wiss. Anst. xi. p. 13, 1894), is not the same as *Whitei* of Gervais, whatever else it may be. Prof. Kraepelin quotes *D. mexicanus*, Peters, and *D. Gundlachi*, Karsch, as undoubtedly synonymous with it, and *Oiclus Purvesi*, Becker, and *D. Keyserlingii*, Karsch, as doubtfully so. So far as *Oiclus Purvesi* is concerned, this view is quite untenable. The British Museum has recently received from Mr. Forrest specimens of the latter species from Antigua, and I have been able to establish the accuracy of Mons. Simon's observations as to the presence of but two lateral eyes on each side, the feature upon which the genus *Oiclus* was based. In addition to this the species is characterized by sundry well-marked specific features, sufficient, apart from the eyes, to differentiate it from all the members of the genus *Diplocentrus* known to me.

Diplocentrus antillanus, Kraepelin (*loc. cit.* p. 16), is not identical with *D. antillanus*, Pocock, but is either the same as, or closely allied to, *D. Whitei*, Gervais, and *D. rectimanus*, Poc.

Family Bothriuridæ.

Genus UROPHONIUS, Poc.

Urophonius granulatus, sp. n.

♀.—*Colour* (faded) yellow, indistinctly variegated with

black, a continuous pale band on the median dorsal area of the tergites; femora and tibiæ of legs variegated; sides and lower surface of tail lined with black.

Carapace finely granular, frontal portion smooth. *Tergites* finely granular; the last more coarsely, with two granular crests on each side. *Sterna* smooth, finely punctulate, the last granular in the middle posteriorly. *Tail* of normal thickness, nearly parallel-sided; superior and supero-lateral keel present and granular on segments 1-3, the superior also traceable on segment 4, the lower side of segments 1 and 2 coarsely granular, the granules arranged along the four crests, those in the middle irregularly disposed; the inferior lateral crests very weak on the second segment; third and fourth segments smooth laterally and below, without crests; fifth segment with three inferior granular keels extending along the posterior two-thirds of the segment, the area between them irregularly granular in its posterior half; vesicle finely granular laterally and below, as wide as segment 5.

Chelæ: humerus weakly granular and keeled above at the base and in front; brachium and hand smooth, not keeled, punctured; hand slender, a little wider than brachium, narrower than vesicle, its width considerably less than half the length of the movable digit, the median teeth of which are arranged in two irregular rows only in the basal half.

Legs with femora externally finely granular, especially on third and fourth pairs; tarsus 4 with 6-6 spines, tarsus 3 with 5-5 spines, tarsus 2 with 2-2 spines, tarsus 1 with 1-1 spines.

Pectinal teeth 17; apices of each half of genital operculum rounded.

Measurements in millimetres.—Total length 33.5; length of carapace 4.3, of tail 19.5; width of vesicle 2, of hand 1.5, of brachium 1.3; length of movable digit 4.

Exact locality doubtful, probably Chili, the specimen being contained in a tube with examples of *Bothriurus coriaceus*, a species which has been recorded from Coquimbo, &c.

The female of this species may be recognized from that of *brachycentrus* (= *Jheringii*, Poc.) by the following features:—

- a. Third segment of tail entirely smooth and keelless below, smooth tubercles or granules on lower side of first segment arranged in four longitudinal lines, the medians more coarsely and irregularly granular; second segment with two irregular rows of rounded tubercles below; superior crests present and granular on segments 1-4, supero-lateral present and granular

- on segments 1-3; vesicle granular to the base of aculeus; carapace and terga finely granular. *granulatus*, sp. n.
- b. Third segment of tail granular below, superior and supero-lateral crests obsolete on segments 1-4; segments 1 and 2 more coarsely and irregularly tubercular below, the first with an anterior transverse crest of tubercles; vesicle punctured; tergites and carapace smooth and polished *brachycentrus*, Thor.

LXI.—*The Scorpions of the Genus Væjovis contained in the Collection of the British Museum.* By R. I. POCKOCK.

Genus VÆJOVIS, C. Koch.

Væjovis variegatus, sp. n.

♀.—*Colour* reddish ochre-yellow or reddish brown; carapace with black tubercle and irregular lateral blackish patches; tergites regularly marked, lateral margin black, with a yellow stripe separating it from a broad black patch; the median keel marked with a very narrow black stripe which sometimes expands in front and behind; between this and the large lateral patch there is a deep black spot, narrowed and projecting inwards in front, where it sometimes fuses with the expanded portion of the keel-stripe; tail clouded below and laterally with black, the position of the lower keel emphasized by black stripes; vesicle and upper surface of tail clear reddish brown.

Palpi reddish brown, scarcely at all infuscate; legs strongly striped externally, with pale tarsi and protarsi; lower surface pale, last sternite infuscate at the sides.

Upper surface of *trunk* coarsely granular. *Tail* more than four times length of carapace, which equals its first and second segments in length; anterior segments granular above and laterally; fourth and fifth segments smooth above and laterally; superior and supero-lateral keels strongly developed, granular, dentate posteriorly, except the supero-lateral on the fourth segment; segments 1 to 4 entirely smooth and polished below, the median keels entirely obsolete, the lateral merely represented by a low, indistinct, smooth ridge; fifth segment with its lower surface finely and closely granular throughout; *vesicle* entirely smooth and, like the lower side of the tail, punctured.

Chelæ: humerus granular above, in front, and finely below, with well-developed superior and anterior crests; brachium with the upper and lower anterior crests well

developed and granular, with a few large granules above and below, smooth on its upper and posterior surfaces; hand entirely smooth, without crests, punctured, hand-back about three quarters the length of the movable digit, which has 7 teeth on the inner row.

Legs with trochanteres and femora finely granular externally; patellæ weakly granular also.

Sterna quite smooth, punctured.

Pectines with 16-17 teeth.

Measurements of type.—Total length 45 millim.; length of carapace 5.5, tail 25.

♂.—Smaller than female; more coarsely granular; lower side of fourth caudal segment more distinctly granular posteriorly, and the sides of the fourth and fifth caudal segments finely granular.

Hand subcostate above, but not granular.

Pectines larger, with 17-18 teeth.

Measurements in millimetres.—Total length 36; length of carapace 4.5, tail 23.

Loc. Amula in Guerrero, Mexico (*H. H. Smith*).

Væjovis nigropictus, sp. n.

Colour much as in *variegatus*, the tergites marked with four black bands, one on each side close to the middle line and one close up to the margin, leaving a wide yellow space between; tail mostly pale, the keels of the lower surface nigro-lineate; legs and palpi pale.

Lower surface of fifth caudal segment more coarsely and less closely granular than in *variegatus*.

Pectinal teeth 17-18.

Loc. Jalisco, Mexico (*Schumann*).

Væjovis bilineatus, sp. n.

Colour a uniform yellowish red; carapace variegated; terga with a large black patch on each side of the middle line, forming a pair of black stripes.

Closely allied to *V. variegatus* in having the inferior caudal keels absent and infero-lateral scarcely visible and entirely smooth; the hand smooth, punctured, without crests; brachium also scarcely crested.

Pectinal teeth 15.

Measurements in millimetres.—Total length 25; length of carapace 4, tail 15.

Loc. San Diego, Texas (*Wm. Taylor*).

Væjovis nigrescens, sp. n.

Colour of trunk, limbs, and tail a tolerably uniform brown, tips of fingers reddish.

Carapace rather coarsely granular, but not closely on the interocular frontal area.

Terga coarsely but sparsely granular, the granules forming distinct lateral keels.

Tail thick and longish, more than four times the length of the carapace, second segment broader than long, third as broad as long; superior and supero-lateral keels granular, posteriorly dentate; infero-lateral low, but quite smooth, infero-median obsolete, only just traceable; upper surface of segments 1 and 2 granular, of the rest almost entirely smooth; keels of fifth segment only crenulate, its lateral surface very weakly and obsoletely granular above, the median keel represented merely by a low ridge; *vesicle* punctured, also weakly granular.

Chelæ: humerus weakly granular above and below, coarsely granular in front, furnished with four strong granular crests; brachium also furnished with four strong granular crests, with a row of strong granules on its anterior surface; hand costate, the finger-keels distinct and smooth, the three inner crests strong and strongly granular; fingers long, the movable longer than the carapace and longer than the fifth caudal segment, at least twice the length of the hand-back.

Legs externally granular.

Sterna smooth, the last with a distinct crest and a few granules on each side.

Pectines short, teeth 18-19.

Measurements in millimetres.—Total length 58; length of carapace 7, of tail 34, of hand-back 4, of movable digit 8.8.

Loc. Mexico (54. 76).

Væjovis subcristatus, sp. n.

♂.—*Colour* reddish yellow; ocular tubercle black; tergites with a V-shaped black patch and a badly defined submarginal black spot; tail nigro-lineate beneath.

Carapace somewhat coarsely granular; *terga* also furnished with coarse granules; *sterna* smooth, the last with a smooth crest on each side. *Tail* long, at least five times the length of the carapace, which is shorter than the fifth segment; the inferior and infero-lateral keels of segments 1 to 4 visible as distinct smooth punctured ridges, the laterals at most very slightly crenulate on segments 3 to 4; lateral keel of fifth

segment forming a weakly crenulate ridge; lower surface of fifth sparsely granular, lateral intercarinal spaces of segments 1 to 4 practically smooth; vesicle smooth, punctured.

Chelæ: the posterior crests on brachium developed, but smooth; hand wide, entirely smooth, punctured, and scarcely visibly crested; the width about two thirds the length of the hand-back, which is almost as long as the movable digit, the latter about as long as the fourth caudal segment.

Pectinal teeth 18.

♀.—Resembling the male, but less granular, the antecular area being nearly smooth; tail shorter; hand narrower, its width about half the length of the movable digit.

Pectinal teeth 16–17.

Measurements in millimetres.—♂. Total length 51·5; length of carapace 5·5, tail 31; width of hand 3; length of movable finger 4·5. ♀. Total length 52; length of carapace 6, tail 29; width of hand 2·8; length of movable digit 5.

Loc. St. Andres, Mexico. In the collection of Count Keyserling.

Differs from the species belonging to the *V. mexicanus* section in having the four inferior caudal keels smooth, also the hand in both sexes entirely smooth and keelless.

Væjovis cristimanus, sp. n.

♀.—*Colour* a uniform reddish brown, not variegated; legs yellower.

Closely allied to *V. subcristatus*, but, apart from the colour-differences, recognizable by having the palpi more strongly crested, the posterior surface of the brachium being weakly granular and its inferior crest distinctly crenulate; the hand is also distinctly crested, the crests on its inner surface being granular.

Terga visibly tricostrate; upper surface of fifth caudal segment smooth; superior and supero-lateral crest on the fifth segment granular; *vesicle* granular below and more coarsely punctured.

Pectinal teeth 18–19.

Measurements in millimetres.—Total length 63; length of carapace 7·3, tail 36.

Loc. Zacatecas, Mexico (85. 40).

Væjovis crassimanus, sp. n.

♂.—*Colour* a tolerably uniform palish yellow, lightly infuscate in parts; an indistinct fuscous patch on each side of the middle line on the tergite.

Trunk coarsely granular above; smooth below, except for

a few granules and a pair of weakly granular keels. *Tail* long and slender, nearly five times the length of the carapace, which is shorter than its fifth segment; first segment about as wide as long, second distinctly longer than wide, fifth nearly three times as long as wide; keels as in *V. mexicanus*, but the terminal tooth of the superior and supero-laterals not so large, being scarcely noticeably enlarged on the first and fourth segments; fifth with a strong median lateral crest extending over half the segment; the intercarinal spaces coriaceous, but almost entirely devoid of granules; *vesicle* smooth.

Chelæ with keels and granules as in *mexicanus*; hand very large, keeled, the keels weakly granular, the width almost equal to the length of the hand-back and excelling the width of the first segment of the tail.

Pectinal teeth 15.

♀.—Differs from the male in its shorter thicker tail, the inferior keels of which are less well developed, the medians on the first being obsolete and on the second weak and scarcely granular; hand smaller and quite smooth, practically without crests and without granules, shining and punctured; hand narrower than the fifth caudal segment.

Measurements in millimetres.—Total length (♂) 58; length of carapace 5·8, tail 36 (width of its fifth segment 3, length 8·8); width of hand 4·2, length of movable digit 6·5. Total length (♀) 43; length of carapace 5, tail 24; width of hand 2, of fifth caudal segment 2·5, length of latter 5·5.

Loc. San Diego, Texas (*William Taylor*).

Væjovis granulatus, sp. n.

Colour variegated black and reddish brown; external surface of legs also variegated; sterna and coxæ sparsely spotted.

Trunk granular above, as in *V. mexicanus*. Upperside of *tail* rather coarsely granular, its lateral and inferior surfaces very coarsely granular between the keels; keels developed and granular, as in *V. mexicanus*; *vesicle* granular below. *Tail* short and thick, about four times as long as the carapace, which is as long as its fifth segment; fourth segment almost as wide as long, third much wider than long, fifth about two-thirds as wide as long.

Chelæ as in *V. mexicanus*, but the hand thicker and the digits shorter, the width of the hand about two thirds the length of the movable digit.

Pectinal teeth 15.

Measurements in millimetres.—Total length 33; length of carapace 4, tail 17.

Loc. Mexico (*Patrick Geddes*).

Belonging to the same category as *V. mexicanus*, C. Koch ('Die Arachniden,' iii. p. 51, 1836), of which the British Museum has several examples from the city of Mexico and the Lake of Chalco, with the inferior caudal keels granular; but differs in having the tail thicker, and the intercarinal spaces coarsely and closely granular. In *V. mexicanus* the intercarinal spaces are at most weakly granular, the inferior being almost wholly smooth, and the fifth segment of the tail is longer than the carapace, the third caudal segment is longer than wide.

Væjovis pusillus, sp. n.

Colour: densely variegated above and below and on the legs and palpi; tergites with a median triangular reddish patch, a V-shaped mark of the same colour, a submarginal yellow stripe, and a clear yellowish-red spot on each side of the middle line; the general pattern of coloration being describable as consisting of a fine yellow band separated by four black bands.

Belonging to the same category as *V. mexicanus* of Koch; with the inferior and infero-lateral caudal crests developed and granular; the lateral and inferior intercarinal spaces very finely and closely granular or coriaceous, also furnished with a few larger granules; vesicle granular below, fifth segment of tail with a very distinct and long median lateral crest.

Palpi constructed very much as in *V. mexicanus*; but the crests, especially on the brachium, much weaker, the posterior crest of the upper and under surfaces very little pronounced.

Pectinal teeth 11–12.

Total length 20–25 millim.

Loc. Omilteme, in Guerrero, 7000 to 9000 feet, under rotten logs (*H. H. Smith*).

The species described in the preceding pages may be determined as follows:—

1. Tail thicker; the inferior and usually the infero-lateral crests of segments 1–4 obsolete, entirely smooth, marked with large punctures; last abdominal sternite smooth, not crested; hand (except in *nigrescens*) smooth, scarcely crested in ♂; brachium with posterior crests weak.
- a. Hand without crests and granules, at least the posterior crests of brachium smooth or almost obsolete; movable digit shorter, the fifth caudal segment variegated black and yellow.

- a^1 . Terga yellow, marked with only one black patch on each side; the rest of the body not variegated. *bilineatus*, sp. n.
 b^1 . Terga yellow or red, but marked with two distinct black patches on each side of the middle line.
 a^2 . The lateral tergal patch closer to the margin, leaving a broader yellow band; legs entirely pale; tail with only the lower keels lined with black *nigropictus*, sp. n.
 b^2 . The lateral tergal patch more remote from the margin; legs and lower side of tail strongly blackened *variegatus*, sp. n.
 b . Hand with inner surface crested and strongly granular; crests on brachium all strong and granular; movable digit longer than fifth caudal segment, uniformly blackish *nigrescens*, sp. n.
2. Four inferior keels on caudal segments 1-4 visible as smooth upstanding ridges, of which only the infero-lateral keels on the third and fourth are at most indistinctly crenulate.
 a . Trunk banded black and yellow; hand in both sexes without crests and entirely smooth: posterior surface and posterior inferior crest of brachium, as well as lower surface of vesicle, punctured, not granular *subcristatus*, sp. n.
 b . Trunk not banded; hand distinctly crested, the inner crests granular; posterior surface and posterior inferior crest on brachium, as well as lower side of vesicle, granular *cristimanus*, sp. n.
3. Inferior and infero-lateral caudal keels developed and granular; sometimes the medians on segments 1-2 smooth; hand and brachium usually crested and granular.
 a . Inferior and lateral intercarinal spaces of tail coarsely and closely granular; tail short and robust; distinctly variegated *granulatus*, sp. n.
 b . Inferior and lateral intercarinal spaces either smooth or at most marked with a few granules.
 a^1 . Of small size (20-25 mm.); pectinal teeth 11-12; distinctly variegated above and on the legs; also the coxæ, pectines, and sterna diversified with blackish spots *pusillus*, sp. n.
 b^1 . Larger size, adults not less than about 45 mm.; pectinal teeth not less than 15; palpi and legs not distinctly variegated; lower surface of trunk without fuscous spots.
 a^2 . Lateral intercarinal spaces of tail without granules; upper keel of fourth without enlarged terminal denticle; hand in ♀ not crested nor granular *crassimanus*, sp. n.
 b^2 . Lateral intercarinal spaces of tail granular; upper keel of fourth with terminal denticle much enlarged; hand in ♀ crested and granular *mexicanus*, Koch.

LXII—*Descriptions of some new Species of Syntomidæ, chiefly in the Oxford Museum.* By HERBERT DRUCE, F.L.S. &c.*Pseudopompilia mimica*, sp. n.

Female.—Primaries and secondaries brownish black: primaries shot with greenish blue beyond the cell and along the inner margin; a tuft of greenish-white scales at the base, the fringe black: secondaries with a small semihyaline spot at the base. The underside of both wings very similar to the upperside; the primaries with a reddish-brown streak at the apex and along the inner margin. The head, collar, tegulæ, thorax, abdomen, and legs black; the legs with a yellowish-white streak on the upperside; the antennæ black, with the shaft sordid white from the base to the middle.

Expanse 2 inches.

Hab. Amazons (*in the Hope Collection, Mus. Oxford*).

This very remarkable species closely resembles *Myrmecopsis vespa*, Herr.-Schäffer, also from the Amazon region.

Calonotos tripunctata, sp. n.

Male.—Primaries and secondaries black; a small green spot at the base and a green streak partly along the costal margin; an elongated white spot below the cell about the middle of the wing, and a rather large round white spot at the end of the cell nearer the apex: secondaries with a white spot on the middle of the costal margin. Underside very similar to the upperside; the costal margin of the secondaries streaked with green at the base. The head, antennæ, tegulæ, thorax, abdomen, and legs black; the abdomen striped from the base to the anus with three wide, greenish-white lines, one down the middle, and one on each side.

Expanse $1\frac{3}{4}$ inch.

Hab. Trinidad (*Lowsley, in Mus. Druce*).

Calonotos chryseis, sp. n.

Female.—Primaries above dark golden green; underside much paler, with the veins black: secondaries black, with a few green scales in the cell; underside pale green, with black veins. Antennæ and front of the head black, with two small white spots between the eyes; palpi black. Collar golden green, edged with black and three small white dots, one in

the middle and one on each side; tegulæ black, golden green at the base; thorax golden green; abdomen black, with three white spots close to the base and three rows of golden-green spots extending from the base to the anal angle; legs black; the underside of the abdomen with a row of white spots.

Expanse 2 inches.

Hab. Bolivia (*in the Hope Collection, Mus. Oxford*).

This species somewhat resembles *Eupyra bacchaus*, Schaus.

Homæocera lophocera, sp. n.

Male.—Primaries and secondaries hyaline: primaries, the base, costal, outer, and inner margins broadly black; a rather wide black band crosses the wing at the end of the cell, extending from the costal margin to the anal angle; two small blue dots at the base of the wing: secondaries broadly edged with black from the apex to the anal angle; the veins of both wings black. The head, antennæ, tegulæ, thorax, part of the abdomen, and legs black; a large white spot on each side of the thorax and one at the base of each leg; the last three segments of the abdomen and the anal tuft orange-red.

Expanse $2\frac{1}{4}$ inches.

Hab. Brazil (*in the Hope Collection, Mus. Oxford*).

Homæosoma stictosoma, sp. n.

Female.—Primaries and secondaries yellowish hyaline, the veins all black; primaries, the base black, the apex broadly black, the outer and inner margins black: secondaries edged with black from the apex to the anal angle, where it is broadest. The head, antennæ, thorax, abdomen, and legs black; a white spot on each side of the head, a metallic-blue spot on both the tegulæ; a white spot at the base of the thorax; two white and two blue dots on the first segment, and a central row of four white spots down the abdomen, also a row of white spots on each side of the abdomen.

Expanse 2 inches.

Hab. Colombia (*Chesterton, in the Hope Collection, Mus. Oxford*).

Trichura mathina, sp. n.

Male.—Primaries and secondaries yellowish hyaline; the outer and part of the inner margin edged with black; the veins yellow: secondaries edged with black from the apex to

the anal angle; the end of the cell black. The head, collar, tegulæ, and thorax black, the collar and tegulæ edged with yellow; the base of the thorax and the first and third segments of the abdomen yellow; the abdomen black; antennæ yellow-black near the base; the legs brownish yellow.

Expanse $1\frac{3}{4}$ inch.

Hab. Amazons, Pará (*Bates, Mus. Druce*).

This species is allied to *T. aurifera*, Butler.

Sarosa xanthobasis, sp. n.

Female.—Primaries and secondaries hyaline; the veins, costal margin, outer and inner margins edged with black, the apex broadly black: secondaries edged with black. The head, antennæ, and palpi black, the front of the head and the collar metallic blue; the thorax, tegulæ, abdomen, and hind legs bright chrome-yellow, the first and second pair of legs brownish black; the anal segments of the abdomen bluish black.

Expanse $2\frac{3}{10}$ inches.

Hab. Ecuador (*in the Hope Collection, Mus. Oxford*).

Mallodeta sanguipuncta, sp. n.

Male.—Primaries and secondaries hyaline; the veins black; the base, apex, outer and inner margins broadly black, a wide black band at the end of the cell: the secondaries edged with black from the apex to the base. Antennæ black, tipped with white on the upperside; the head, collar, tegulæ, thorax, abdomen, and legs black; two small spots at the back of the head, two at the base of the abdomen, and a row on each side white; the tegulæ edged with red; two red spots at the base of the abdomen, and two on the third segment somewhat indistinct.

Expanse 2 inches.

Hab. Paraguay (*in the Hope Collection, Mus. Oxford*).

Mesothen ignea, sp. n.

Male.—Primaries and secondaries hyaline, the veins all black; the apex of the primaries broadly bordered with black; the outer and inner margins edged with black: secondaries with the apex, outer and inner margins edged with black. The head, antennæ, palpi, and legs black; the collar, tegulæ, thorax, and abdomen dark chrome-yellow; the tegulæ spotted with black and a central black spot on each segment of the abdomen, the first three being the largest.

Expanse $1\frac{7}{10}$ inch.

Hab. Merida (*in the Hope Collection, Mus. Oxford*).

Phœnicoprocta metachrysea, sp. n.

Male.—Primaries and secondaries hyaline, the veins, costal margin, apex, outer and inner margins of both wings black. The head, antennæ, palpi, thorax, abdomen, and legs black; front of the head metallic blue, the collar and tegulæ edged with blue, a central row of greyish-white spots on the abdomen, the anal segments and anal tuft yellow.

Expanse $1\frac{1}{4}$ inch.

Hab. Cayenne (in the Hope Collection, Mus. Oxford).

Urolosia opalocincta, sp. n.

Male.—Primaries and secondaries hyaline; the veins all black; the costal, outer, and inner margins narrowly edged with black, widest at the anal angle: secondaries broadly bordered with black from the apex to the anal angle. The head, antennæ, palpi, collar, tegulæ, thorax, abdomen, and legs black; the collar, tegulæ, and base of the primaries irrorated with a few metallic-green scales; the second and third segments of the abdomen opalescent white, more so in the female than the male; the anal tuft black.

Expanse $1\frac{3}{4}$ inch.

Hab. Cayenne (in the Hope Collection, Mus. Oxford).

Herea xanthogaster, sp. n.

Male.—Primaries and secondaries brownish hyaline, with the veins and margins all black. The head, antennæ, thorax, abdomen, and legs all black; the underside of the abdomen from the base to the anus bright chrome-yellow.

Expanse 1 inch.

Hab. Cayenne (in the Hope Collection, Mus. Oxford).

Chrysostola fulvisphex, sp. n.

Male.—Primaries and secondaries hyaline, the veins brownish black: primaries, the costal and inner margins yellowish brown, the apex and outer margin edged with black: secondaries edged with black. Antennæ black; the head, thorax, and abdomen yellowish brown, the anal half of the abdomen the darkest; the collar and tegulæ black, edged with yellow; the legs yellowish brown.

Expanse $1\frac{1}{10}$ inch.

Hab. Cayenne (in the Hope Collection, Mus. Oxford).

Chrysostola sanguiceps, sp. n.

Male.—Primaries and secondaries hyaline: primaries broadly black at the apex, the outer and inner margins black, the veins black: secondaries edged with black from the apex to the anal angle, the veins yellow. The head, thorax, and basal half of the abdomen chrome-yellow, the anal half of the abdomen black; antennæ black; legs chrome-yellow.

Expanse 1 inch.

Hab. Cayenne (in the Hope Collection, Mus. Oxford).

Paramya picta, sp. n.

Male.—Primaries semihyaline, the base and partly along the inner margin chrome-yellow, the apex broadly brownish black; a large black spot at the end of the cell, beyond which the wing is crossed by a rather indistinct pale yellow band; a small black streak on the inner margin close to the anal angle: secondaries chrome-yellow, the apex black. The head, antennæ, last three segments of the abdomen, and legs black; the thorax and abdomen chrome-yellow.

Expanse 1 inch.

Hab. Cayenne (in the Hope Collection, Mus. Oxford).

Cosmosoma orathidia, sp. n.

Male.—Primaries and secondaries hyaline: primaries, the base, apex, outer and inner margins broadly black; a wide zigzag black band crosses the wing at the end of the cell from the costal margin to the anal angle: secondaries, the costal, outer, and inner margins edged with black. The veins of both wings black. The head, palpi, antennæ, thorax, abdomen, and legs black; the tegulæ black, edged with metallic blue; a large red spot on both sides of the abdomen at the base and a row of metallic-blue spots extending from the base to the anus on each side.

Expanse $1\frac{3}{10}$ inch.

Hab. Nicaragua, Chontales (T. Belt, in the Hope Collection, Mus. Oxford).

Histiæa glaucozona, sp. n.

Male.—Primaries brown, slightly shaded with pink in the cell; two minute blue dots at the end of the cell, beyond which is a very indistinct brownish-white band, similar in shape to the yellow band on the primaries of *H. amazonica*: secondaries brown, with a large square-shaped red spot beyond the

middle. Underside: primaries brown, bright pink in the cell, two small spots beyond and one large spot at the anal angle cream-colour; the spot on the secondaries is quite small and slightly reddish in colour. The head, antennæ, collar, tegulæ, thorax, abdomen, and legs brown; a row of metallic-blue spots on each side of the abdomen.

Expanse $2\frac{1}{2}$ inches.

Hab. Amazons (*in the Hope Collection, Mus. Oxford*).

This species is closely allied to *H. amazonica*, Butler.

Cyanopepla obscura, sp. n.

Male.—Primaries and secondaries dull brown, a small red spot and a metallic-green dot close to the base of the primaries and a small red spot on the costal margin of the secondaries near the apex; on the underside both wings are shot with bright metallic blue from the base to beyond the middle. The head, antennæ, thorax, and abdomen black, the collar metallic blue, each segment of the abdomen edged with metallic-blue scales; legs black.

Expanse $1\frac{1}{2}$ inch.

Hab. Peru (*in the Hope Collection, Mus. Oxford*).

Neacerea albiventus, sp. n.

Male.—Primaries and secondaries black: primaries with a small, transverse, white band about the middle, not reaching either margin: secondaries, the inner margin broadly greyish white; the fringe white at the apex of the primaries. Underside very similar to the upperside, but with the marking much whiter. The head, antennæ, collar, tegulæ, and thorax black; abdomen above dark glossy blue, on the underside white. Legs black above, white on the underside.

Expanse $1\frac{1}{4}$ inch.

Hab. South Brazil, Minas Geraes (*Rogers, in the Hope Collection, Mus. Oxford*).

Neacerea dizona, sp. n.

Male.—Primaries black, crossed by two semihyaline bands, neither of which extends to the margins of the wing; the first band before the end of the cell, the second beyond nearer the apex: secondaries hyaline, broadly bordered with black from the apex to the anal angle. The head, antennæ, palpi, tegulæ, thorax, abdomen, and legs black; collar red; the underside of the thorax and abdomen white.

Expanse $1\frac{3}{10}$ inch.

Hab. Cayenne (*in the Hope Collection, Mus. Oxford*).

Loxophlebia postflavia, sp. n.

Male.—Primaries and secondaries hyaline, the veins all black : primaries, the base and apex broadly black, the outer and inner margins edged with black : the secondaries edged with black from the apex to the anal angle. The head, antennæ, thorax, and abdomen black ; the three anal segments of the abdomen sordid yellow ; the legs black.

Expanse $1\frac{1}{10}$ inch.

Hab. Cayenne (in the Hope Collection, Mus. Oxford).

Lymire strigivenia, sp. n.

Male.—Primaries smoky black, the veins rather darker : secondaries hyaline dusky black along the costal margin, and broadly so along the inner margin. The head, antennæ, palpi, collar, tegulæ, thorax, abdomen, and legs black.

Expanse 1 inch.

Hab. Cayenne (in the Hope Collection, Mus. Oxford).

Psilopleura polia, sp. n.

Male.—Primaries and secondaries whitish hyaline : primaries, the base of the cell, a spot at the end of the cell, the apex, anal angle, and inner margin shaded with dark and light brown, darkest along the inner margin : secondaries edged with brown. The head and thorax pale brown ; antennæ pale brown, tipped with white ; tegulæ dark brown, with a pale brown streak down the middle ; abdomen black above, with the base and sides yellow ; legs brown.

Expanse $1\frac{1}{2}$ inch.

Hab. Espiritu Santo (in the Hope Collection, Mus. Oxford).

Teucer albapese, sp. n.

Male.—Primaries and secondaries hyaline, the veins all black ; a large spot at the end of the cell black ; the apex, outer and inner margins broadly black, the fringe at the apex white : secondaries, the costal, outer margin, and anal angle broadly black. The head, antennæ, thorax, abdomen, and legs black ; the front of the head and the underside of the thorax and abdomen white.

Expanse 1 inch.

Hab. Cayenne (in the Hope Collection, Mus. Oxford).

This species is closely allied to *Anaphlebia caudatula*, Felder.

Holophæa cærulea, sp. n.

Female.—Primaries and secondaries uniformly dark bluish black. The head, antennæ, thorax, and legs black; abdomen dark glossy blue-black; the collar and the edges of the tegulæ bright red.

Expanse $1\frac{1}{4}$ inch.

Hab. Ecuador (in the Hope Collection, Mus. Oxford).

Atyphopsis roseiceps, sp. n.

Male.—Primaries and secondaries semihyaline greyish white, the veins all dark brown, the apex dark brown. The head, antennæ, collar, tegulæ, thorax, abdomen, and legs pale greyish brown; the top of the head and the fourth and fifth segments of the abdomen pale red; the anus black.

Expanse $1\frac{1}{4}$ inch.

Hab. S.E. Brazil, Rio Janeiro (in the Hope Collection, Mus. Oxford).

The specimen is in very poor condition and much faded.

LXIII.—On the Place of the Sponges in the Classificatory System and on the Significance attributed to the Embryonic Layers. By EDMOND PERRIER*.

IN a note published in the last number of the 'Comptes Rendus' M. Yves Delage proposes "to raise the Spongiariæ to the rank of a branch by contrasting them, under the name Enantioderma (ἐναντίος, contrary), with the Cœlenterata, if not, indeed, under the title Enantiozoa, with all other animals, Protozoa, Mesozoa, and Metazoa, in which the invagination of the layers, when they exist, takes place in the normal way." Since as early as 1881, in the first edition of my book 'Les Colonies animales et la Formation des Organismes' (p. 764), I laid claim to a distinct series in the animal kingdom on behalf of the Sponges, and as, since then, I have not ceased to defend this manner of regarding them †, I cannot but congratulate myself on seeing, after the lapse of sixteen years, my opinion embraced by the industrious professor of the Sorbonne. Since the Sponges were already called by this name, and were also termed Spongiariæ, Spongozoa, Porifera, Polystomata, &c., I did not, indeed, consider it advisable to add a new number to this already copious list.

* Translated by E. E. Austen from the 'Comptes Rendus,' t. cxxvi. no. 8 (February 21, 1898), pp. 579-583.

† Cf. my 'Traité de Zoologie,' pp. 407 and 537. Huxley, in 1874, in his embryogenic classification, already separated the Sponges from the Cœlenterata under the name POLYSTOMATA; Milne-Edwards, in 1855, and de Blainville, in 1822, had treated them in the same way. But the former associated them with the Infusoria, the latter with the Infusoria and the Corallina.

The characters upon which I had relied for establishing the Sponges as a distinct series—*ramified or irregular shape, absence of general cavity, great development of mesoderm, ciliated chambers lined with choanocytes, absence of nematocysts and of tentacles*—were known already; but having taken care to define strictly the starting-points of the nomenclature that I adopted, and to explain clearly what I meant by the terms *series, branch, class, &c.**, they were amply sufficient to establish a due conception of Sponges. The apparently new character invoked by M. Delage would therefore only serve to justify the importance of those upon which I had dwelt, even though it should be found not to be open to criticism and were freed from the, at the very least, debatable interpretations with which it has been surrounded.

For anyone who reflects that the organization of animals is dominated by general rules, it is difficult to admit that a zoological group can be *opposed* to another, and especially to the remaining groups as a whole; in truth the idea would appear to be but a metaphor to be added to those with which the language of zoology is already obscured, if the author did not take care to tell us that "*in the Spongiarix, alone among all creatures, the normal invagination of the layers is reversed, the endoderm passing to the surface to form the epidermis, and the ectoderm sinking into the interior to form the digestive cavities.*" Of the causes which could have produced so extraordinary a reversal M. Delage tells us nothing, and yet zoology is to-day too rich in materials for it to be still possible to suppose, if we take our stand on the ground of transmutation, that reversals of layers and transformations of organs occur which could not be connected with causes that are at least probable.

But in order to arrive at the conclusion that the Sponges are the reverse of the rest of the animal kingdom, M. Delage has recourse to processes of argument and to generalizations the value of which it is important to determine.

If we were ignorant, he remarks, of the development of Sponges, and the larvæ of these animals were presented to embryogenists with the request that they should name the layers and predict their development, *there is not one of them* who would not say that the flagellate cells are the ectoderm, that the granular cells are the endoderm, and that the invagination of the latter within the former will ensue. There is therefore no doubt as to the homologization of the larval layers.

The definition of the *homologies* is due to Geoffroy Saint-

* 'Colonies animales,' p. 744, and 'Traité de Zoologie,' p. 403.

Hilaire, who termed them *analogies*; it is based on the *principle of connexions*—that is to say, that it rests on the relative position of the organs in the adult state and on the identity of their mode of succession during the embryonic period, to the exclusion of all consideration of function or of structure. The endoderm being essentially that which is within, the ectoderm that which is without, as indicated by their names, it is clear that there is neither endoderm nor ectoderm in a hollow body, such as the most simple form of sponge-larva, formed of a single layer of cells, and that, in order to remain in conformity with the precise language of comparative anatomy and embryogeny, it will be necessary, if one half of this body is invaginated within the other, to apply the designation *entoderm* to that which becomes internal and to term *exoderm* that which remains external. The proposition of M. Delage might therefore be enunciated simply as follows:—

The larva of Sponges is an ellipsoid, one cap of which is formed by flagelliferous, the other by granular cells; the cap of flagelliferous cells is invaginated into the other and constitutes the entoderm.

In designating this cap by the name *exoderm*, in homologizing it with the exoderm of the rest of animals, we run counter to the very definition of homologies, for it is implicitly agreed that the character of the exoderm is derived not from its position, but from the form of the anatomical elements composing it.

The character invoked by M. Delage amounts therefore to saying that the entoderm of Sponges is formed of flagelliferous and their exoderm of granular elements; it is a *histological character*, like that which is derived from the presence of the choanocytes in the ciliated chambers—nay, more, *it is exactly the same character*, since M. Delage recognizes that the ciliated chambers originate from his supposed exoderm, and the question of the position of the Sponges remains precisely at the point at which it had been left by his predecessors. The apparent progress results simply from the credence once more accorded to the metaphysical theory of the embryonic layers and of their predestination—a theory in some sort *retroactive*, like all those which claim to apply to the lower animals conceptions derived from the study of the higher animals, often even of single vertebrates, and based upon structural features which are the result of the activity of primitive animal forms, or are considered as such, but are not yet realized in them. Every animal, it is said, is at first a *gastrula*, composed of an exoderm and an entoderm: the generalization is gratuitous; the exoderm and entoderm are

recognized by this or that histological structure : it is a proposition contrary to the very definition of homologies ; they are predestined to play such and such a rôle in development : this is metaphysics.

The circumstances appear under a totally different aspect, and no longer lend themselves to any obscurity, if, following the facts without attributing to them any mysterious significance, we remember that the primitive form of every embryo* is not a *gastrula* composed of two layers, as is gratuitously supposed, but a *blastula* more or less approaching the ellipsoidal shape, and constituted by a single layer of cells. This larva is ciliated, and the strokes of the cilia impel it in a fixed direction ; it therefore possesses an anterior and a posterior pole. From the moment at which locomotion is accomplished in a definite direction the cilia of the anterior region of the *blastula* are necessarily those which exhibit the maximum of activity ; their activity exhausts the alimentary reserves of the elements which bear them, while the elements of the posterior region remain crammed with these reserves. The elements which are disburdened of these reserves are always those the multiplication of which is the most active.

This being granted, the *blastula* can follow only two courses in its evolution—either it remains free or else it becomes fixed. If it remains free its *locomotor* anterior region, by reason of its rapid growth, necessarily induces the invagination of the posterior region, which is essentially *nutritive*, and this is why the orifice of invagination, which has for so long been erroneously considered as a primitive mouth, is very generally posterior in the Nephridiate series (“dans la série des Néphridiés”). If, on the contrary, the *blastula* becomes fixed, it does so necessarily (the exceptions to the rule in the animal kingdom are only apparent) by its anterior locomotor region. Indeed, an animal cannot adhere to an obstacle except by pressing against it—that is to say, by applying against it the region which, in its habitual mode of locomotion, it carries in front. It is therefore the ciliated region of the *blastula* that in this case will be covered by the granular region, will proliferate, multiplying its anfractuosités on the inside of its envelope, and will constitute the entoderm : thus is to be explained the particular case of the Sponges, which henceforth there is no need to *contrast* with the rest of the animal kingdom ; they detach themselves from the common branch because they become fixed in the *blastula* state ; in respect to this they diverge from the Polyps, since in the latter the cavity of the *blastula*, already filled with elements,

* Except in the Arthropod series, where the vibratile cilia are absent.

has become a *parenchymella* at the moment of fixation ; here, therefore, no invagination takes place. This, of course, applies in each series only to the primitive larval forms, and not to those which have been modified by tachygenesis. M. Delage's remark, therefore, does not throw any particular light on the problem of the place of the Sponges in classification, and the terms that he employs to designate a group of the animal kingdom already named by the Greeks might lead to error with reference to the signification of what it has been agreed to call the *embryonic layers*.

It remains to be learnt whether the histological characters have as little value as is apparently sometimes believed. Remembering that the entire vegetable kingdom owes its essential characters to the fact that the elements of the plant shut themselves up in an envelope of cellulose, that the faculty of charging themselves with chitin possessed by the free region of the epithelia of Arthropods has suppressed in these animals the vibratile cilia, orientated their organization in an altogether peculiar direction, and justified the creation of a branch for them—it will not appear to be immaterial that the Sponges and the Polyps possess respectively, and each in an exclusive manner as regards the other group, choanocytes or nematoblasts. This is also a consequence of the properties in their protoplasm.

PROCEEDINGS OF LEARNED SOCIETIES.

GEOLOGICAL SOCIETY.

November 17th, 1897.—Dr. Henry Hicks, F.R.S.,
President, in the Chair.

The following communication was read :—

‘ Observations on the Genus *Aclisina*, de Koninck, with Descriptions of British Species, and of some other Carboniferous Gastropoda.’ By Miss J. Donald, of Carlisle.

The Author makes some preliminary observations on the genus *Aclisina*, and considers it advisable to regard *A. pulchra* as the type of the genus, while the so-called *A. striatula* must be placed among the *Murchisoniæ*, and *A. nana* is placed in a new genus. The Author gives a diagnosis of *Aclisina*, de Kon., belonging to the family Turritellidæ, and describes the British species, twelve of which are new, including two new forms placed in a subgenus.

Of the family Murchisonidæ, and in the section *Aclisoides* of the genus *Murchisonia*, the form *A. striatula*, de Kon., and a variety are described ; and a diagnosis of the new genus, in which *A. nana* of de Koninck is placed, is given, followed by a description of the species.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[SEVENTH SERIES.]

No. 6. JUNE 1898.

LXIV.—*Descriptions of some new Scorpions from Ecuador.*
By R. I. POCKOCK.

Family Buthidæ.

Genus TITYUS, C. Koch.

Tityus pugillator, sp. n. (Fig. 1, p. 419.)

♂.—*Colour* of trunk black, of tail greenish black, legs and chelæ yellowish brown.

Carapace and tergites normally granular; sterna very closely and very distinctly granular throughout, except for the usual smooth area on the posterior portion of the third, lateral keels on the last abbreviated.

Tail a little more than five times as long as the carapace, which about equals its fourth segment in length; posteriorly incrassate, the segments increasing in width to the middle of the fifth segment, the fourth very deeply excavated above, its width almost equal to the length of the second segment; the keels normal in number and granulation, the superior keels not ending posteriorly with noticeably enlarged denticles; the intercarinal spaces weakly granular, median lateral crest on second segment represented by a series of four granules, fifth segment about one third longer than wide, width of the fourth about three quarters its length; *vesicle* very weakly granular,

its width about half the length of the carapace, greater than that of brachium, and nearly equal to length of first caudal segment; tooth not close to base of aculeus, as in *forcipula*.

Chelæ with normal crests and granules; hand smooth, normally crested, wide, its inner surface very strongly produced, its width equal to about half the length of the movable digit, less than that part of the immovable which is distal to the tooth; digits not widely separated basally, but the movable strongly lobate, the immovable correspondingly sinuate; 13 rows of teeth on the movable.

Legs granular.

Pectinal teeth 15-16; an angular expansion at the base of the teeth.

Measurements in millimetres.—Total length 51, of carapace 5.5, of tail 30; width of first segment 3, of fifth 4, of vesicle 2.5, of hand 3.3, of brachium 2; length of hand-back 4, of movable digit 6.5.

Loc. Cachavi, N.W. Ecuador, 500 feet (*Rosenberg coll.*).

In thickness of tail and width of hand this species approaches both *T. forcipula*, Gerv., and *T. pachyurus*, Poc., from Colombia, but differs from both in having the chelæ and legs of a much paler colour than the trunk and tail and the digits basally adjacent. From *pachyurus* it further differs in having the abdominal sternal plates coarsely and closely granular, the tergites more closely granular, and the vesicle wider; and from *forcipula* in its less coarsely granular tail, with the superior crests weak and not denticulate, the vesicular tooth further from the base of the aculeus, &c.

Tityus timendus, sp. n.

♂.—*Colour* a uniform black, pectines flavous.

Carapace about as long as fourth caudal segment, like the terga normally crested and granular.

Tail about six times the length of carapace, parallel-sided, first segment as wide as fourth and a little wider than fifth; all the keels strong and coarsely granular, but the terminal granules of the upper crests not enlarged; median lateral crests complete on second segment and represented by about 6 granules lying in the middle of the segment; fourth segment considerably less than twice as long as wide ($4\frac{1}{2} : 7\frac{1}{2}$), width of fifth about half its length and considerably less than length of second; vesicle coarsely granular, its width a little greater than that of brachium, very nearly equal to that of hand; tooth at normal distance from aculeus.

Chelæ normally granular and crested; hand nearly smooth,

crests smooth, of medium strength; width a little greater than that of brachium, equal to area lying between ocular tubercle and posterior border of carapace; digits in contact weakly lobate and sinuate; movable digit less than three times length of width of hand and rather less than twice as great as length of hand-back; 13 rows of teeth.

Legs normally granular and crested.

Sterna granular, fifth much more closely than the fourth, fourth than third, &c., the fifth with coarsely granular keels; second, third, and fourth smooth, shining posteriorly, the smooth patch largest on the third.

Pectinal teeth 19-21; no angular expansion of shaft at base of pecten.

Measurements in millimetres.—Total length 70, of carapace 7.3, of tail 43; width of first segment 4.5, of fifth 4.5; length of latter 8.5; width of vesicle 3.2, of brachium 3, of hand 3.5; length of hand-back 5, of movable digit 9.

Loc. Cachavi, Ecuador (*Rosenberg coll.*).

Judged by the table of species of *Tityus* of the so-called *americanus*-type that I published last year (*Ann. & Mag. Nat. Hist.* (6) xix. pp. 516-517), this new form will fall under heading *b*⁴ of the section devoted to the males alongside of *metuendus*, Poc., which it approaches in dimensions of tail-segments. But the secondary sexual characters are much less strongly pronounced, the tail being less incrassate, the chelæ shorter, the hand narrower, and the digits adjacent. Moreover, in the tail the intercarinal spaces are much smoother, the keels stronger and marked with fewer larger granules, the median lateral keel being complete, though anteriorly weak upon the second segment, while in *metuendus* it is merely represented by a few posterior granules.

Tityus Rosenbergi, sp. n. (Fig. 2, p. 419.)

♂.—*Colour* a uniform black, pectines and tips of digits flavous.

Upper and lower sides of *trunk* carinate and granular, almost as in *T. Cambridgei*.

Tail with its keels and intercarinal spaces much less coarsely granular than in *T. Cambridgei*, of medium length, slender, a little narrowed posteriorly, width of fourth segment a little less than half its length (3:7); fifth segment a little longer than carapace; vesicle a little narrower than brachium and slightly wider than hand; tooth not close to aculeus.

Chelæ long and slender; hand narrower than brachium, strongly keeled, the keels finely granular; digits very long,

the movable more than twice the length of the hand-back, very weakly lobate, furnished with 15 rows of teeth.

Sterna weakly granular, the middle and posterior portions of sterna 1-4 smooth.

Pectinal teeth 21.

Measurements in millimetres.—Total length 69, of carapace 7, of tail 40·5; width of first segment 3·3, of fifth 3·2, length of latter 7·5; width of vesicle 2·5, of brachium 2·6, of hand 2·3; length of hand-back 4, of movable digit 10·2.

Loc. Cachavi, Ecuador (*Rosenberg*).

Falling under heading δ^3 of my synopsis of species based upon females (*op. cit.* p. 518), alongside of *T. Cambridgei*, but differing from the latter in having the intercarinal spaces of the tail and its keels much less strongly granular, the hand narrower and shorter as compared with the movable digit, with the external finger-keel of the hand complete and not mesially broken.

Tityus spinatus, sp. n.

Belonging to the *americanus* section and nearly allied to *T. forcipula*, Gervais, from Ibaque in Colombia.

Colour uniform black or brownish black.

Trunk coarsely granular above; sterna and coxæ closely granular throughout below, with the exception of a small smooth triangular area in the middle of the third sternite.

Tail incassate to the middle of the fourth and fifth segments, the intercarinal spaces thickly and coarsely granular, the superior more finely so; all the keels coarsely granular, the superior denticulate and ending on the second to fourth segments in an enlarged tooth; granules on upper edge of fifth segment forming a denticulate crest; vesicle granular below, tooth close to base of aculeus; vesicle distinctly wider than brachium, a little wider than hand; fifth caudal segment about as long as carapace, its width about two thirds its length; width of fourth about three quarters its own length and almost equal to length of second segment.

Chelæ closely granular, normally costate; hand very slightly wider than brachium; hand-keels not strong, the external finger-keel weak, but not divided; movable digit a little more than twice as long as hand-back, weakly lobate basally, with 15 rows of teeth.

Pectinal teeth 15.

Measurements in millimetres.—Total length 58; length of carapace 6·5, of tail 35; width of its first segment 4, of its

fifth 4·8, length of latter 7; width of vesicle 3·2, of brachium 2·7, of hand 3; length of hand-back 4, of movable digit 8·8.

Loc. Cuença, in Ecuador (95 6. 23. 1).

Differs from the female of *forcipula* in having the tail wider, its upper crests more strongly denticulated, those on the fifth segment in *forcipula* not being denticulate. The differences in the proportions of the tail-segments may be judged by a comparison between the measurements in millimetres given of *T. spinatus* and those of the female of the type of *forcipula*.

♀ of *forcipula*.—Total length of tail 39; width of first segment 3·8, of fourth 4·2, of fifth 4·2; length of fourth 6·2, of fifth 7; width of vesicle 3·4, of brachium 2·5, of hand 2·5; length of carapace 6·5.

These data show that the vesicle is larger as compared with the width of the tail in *forcipula* than in *spinatus*.

Tityus ecuadorensis, Kraepelin.

Tityus ecuadorensis, Kraepelin, J.B. Hamb. Wissen. Anstalten, xiii. 1896, p. 127, figs. 6, 7.

Subspecies *zarumæ*, nov.

Specimens of a species of *Tityus* received from Zaruma in Ecuador may be recognized from the typical form of *ecuadorensis* as follows:—

- a. Humerus, brachium, and trochanter of chelæ
a uniform ochre-yellow, or at most very
slightly variegated with black; sterna 3
to 5, sometimes also 2, clouded with
black; posterior and lateral portions of
carapace much more heavily infuscate;
keels and granulation of fifth caudal seg-
ment and vesicle stronger *ecuadorensis*, Kraep.
(Loja, in Ecuador.)
- b. Humerus, brachium, and trochanter of chelæ
very largely infuscate above; only the
last sternite mottled (the fourth some-
times slightly so at the sides); posterior
and lateral portions of carapace mostly
yellow, lined with black; keels and granu-
lation of fifth caudal segment and vesicle
much weaker *ecuadorensis zarumæ*, nov.
(Zaruma, in Ecuador.)

Male and female examples of this form were obtained by Mr. T. Gunter. The male has the tail long and slender and the hands dilated. Co-types of the principal form have been sent to the British Museum by Prof. Kraepelin, of Hamburg.

The species of the genus *Tityus* here recorded from Ecuador may be recognized by the following table:—

- a. Base of pecten bearing a smooth rounded prominence at the base of the series of teeth (♀).
- a¹. Conspicuously variegated black and yellow.
- a². Humerus and brachium of chela not strongly mottled with black, almost entirely pale..... *ecuadorensis*, Kraep.
(From Loja.)
- b². Humerus and brachium heavily infuscate *zarumæ*, nov. (Sub-specific form from Zaruma.)
- b¹. Mostly a uniform blackish colour; not variegated.
- a³. Tail slender, its intercarinal spaces very weakly granular, its crests also weak; sterna weakly granular; hand narrow, but strongly keeled..... *Rosenbergi*, sp. n.
(Cachavi.)
- b³. Tail thick, fourth and fifth segments wider than first; the intercarinal spaces coarsely and thickly granular; the upper keels of segments 2 to 5 denticulate; hand broader, weakly keeled *spinatus*, sp. n. (Cuença.)
- b. Base of pecten without smooth rounded lobe, at most with an angular projection of the shaft (♂).
- a⁴. Strongly variegated black and yellow .. *ecuadorensis*, Kraep.
(The forms from Loja and Zaruma distinguished as under a² and b².)
- b⁴. Not strongly variegated.
- a⁵. Uniformly black; sterna weakly granular; granules of caudal keels few and large, median lateral keel complete on second segment; hand narrower, its width much less than half the length of movable digit *timendus*, sp. n.
(Cachavi.)
- b⁵. Legs and chelæ paler than trunk and tail; sterna thickly and rather coarsely granular; granules of caudal keels weak and numerous; scarcely a trace of median lateral keel on second segment; hand very broad, its width almost half the movable digit *pugilator*, sp. n.
(Cachavi.)

Family Vejovidæ, Thorell.

Subfamily CHACTINI, Poc.

Genus CHACTAS, Gervais.

Chactas Rosenbergi, sp. n.

Colour black or brownish black, legs yellowish-brown.

Carapace about as long as caudal segments $1 + 2 + \frac{1}{2}$ of 3, granular throughout except on the ocular tubercle and the

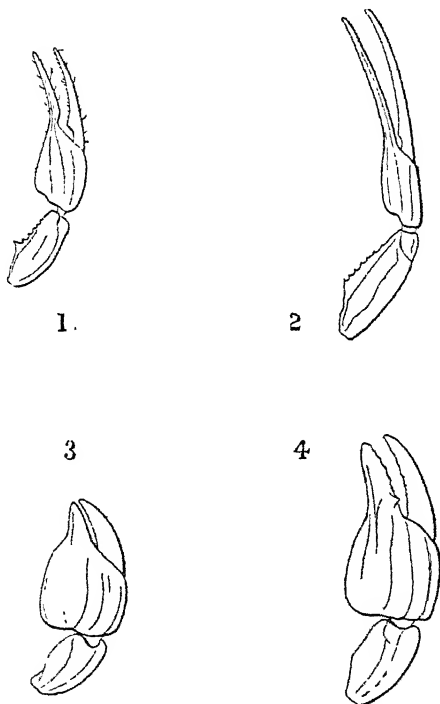


Fig. 1.—Hand and brachium of *Tityus pugilator*, $\times 2$.

Fig. 2.—Ditto of *Tityus Rosenbergi*, $\times 2$.

Fig. 3.—Ditto of *Teuthraustes latimanus*, $\times 2$.

Fig. 4.—Ditto of *Teuthraustes nitescens*, $\times 2$.

two posterior prominences; anterior border deeply excised with rounded frontal prominences, which project far in front of the anterior lateral eye.

Tergites finely granular.

Sternites smooth.

Tail moderately robust; the superior and supero-lateral crests and area between them granular; upper surface of segments smooth in middle, granular at sides; segments 1 to 3 finely granular or coriaceous laterally, smooth and keelless below, the third slightly coriaceous below; fourth distinctly granular below and laterally, with the inferior lateral crest traceable by a series of larger granules, upperside of fourth finely granular mesially; fifth granular above, laterally, and below, the three inferior crests more coarsely granular, with coarser granules between; vesicle large, wider than second segment, granular laterally and below.

Chelæ: humerus finely granular below, coarsely above, the crests strong and granular; two infero-anterior crests; brachium with a row of five posterior pores below, finely granular in front, with a small inferior tubercle, rather coarsely granular above and behind; hand large, its width nearly equal to length of hand-back, finely granularly reticulate above, more coarsely granular externally and internally and at the base of the digits; the network of granules extends on to the inner surface, and is intermixed with larger granules; keel of hand-back strong, granular, area below it smooth, marked in front with an oblique series of 3 pores, with 2 also close to the articulation of the movable digit; immovable digit with strong basal tooth fitting into an excavation of the movable digit, which is only a little longer than the hand-back.

Legs: femora of third and fourth finely granular.

Pectinal teeth 8-10.

Measurements in millimetres.—Total length 65; length of carapace 8.5, of tail 34; width of hand 6.8; length of hand-back 7.5, of movable digit 8.

Loc. Chimbo, 1000 feet, near Guayaquil (*Rosenberg*).

Perhaps most nearly allied to *C. Whymperi*, Poc., from Milligalli, Ecuador (Ann. & Mag. Nat. Hist. (6) xii. p. 20, pl. v. figs. 7-7 b), which it resembles in having the anterior border of the carapace deeply excised in the middle with prominent lateral lobes, which project in advance of the anterior lateral eye, also in the granulation and crest-development of the tail, and in the presence of a large tooth on the immovable digit fitting into an excavation in the movable digit. But *Rosenbergi* has much less coarsely granular carapace and palpi, the hands of which are not nearly so noticeably costate; moreover, the vesicle is granular, not punctured as in *Whymperi*, and, lastly, the legs are yellowish brown.

Genus TEUTHRAUSTES, Sim.

Teuthraustes latimanus, sp. n. (Fig. 3.)

Colour a uniform black above, tarsi ochraceous, vesicle ferrugino-piceous.

Carapace, tergites, and tail uniformly and rather coarsely granular; tubercle continued in front into a long bifid ridge. Upper surface of *tail*-segments finely granular mesially, the second and third smooth in the middle; the median inferior keels weaker than the laterals on segments 1 to 4, scarcely recognizable amongst the granules on the first; superior, supero-lateral, and infero-lateral crests strong and granular; first caudal segment nearly twice as wide as long, its width about equal to the length of the fourth. *Vesicle* broad, furnished laterally and below with seven coarsely granular tracts. Anterior *sterna* smooth, punctured, posterior rather coarsely granular in the middle and laterally.

Chelæ coarsely granular, the granules on the hand forming a network of fused ridges; inner surface of the hand coarsely granular; upper surface externally strongly ribbed; crest of hand-back posteriorly dentate; hand very wide and thick, its width almost equal to the length of the fifth caudal segment and excelling the movable digit; digits short, immovable triangular, only slightly longer than broad, with basal tooth.

Legs 1 and 2 smooth, 3 with granular femur, 4 with femur and patella granular.

Pectinal teeth 7.

Measurements in millimetres.—Total length 48; length of carapace 6·5, of tail 26·5; width of first segment 4, of vesicle 3, of hand 5·5; length of movable digit 4·8.

Loc. Corazon, in Ecuador, 12,000 feet (*E. Whymper*).

Teuthraustes monticola, sp. n.

♀.—*Colour* as in *latimanus*, from which it differs principally in the narrower hand and longer fingers. Hand ornamented above in the middle with low punctured ridges, which towards the inner margin and externally become granular; its width less than length of movable digit; the immovable about twice as long as broad; carapace less coarsely granular, the anterior prolongation of the tubercle shorter and less noticeably divided.

Measurements in millimetres.—Total length 50; length of carapace 7, of tail 26·5; width of first segment 4·2, of vesicle 3·3, of hand 6; length of movable digit 6·5.

Loc. Machachi, in Ecuador, 9000–10,000 feet (*E. Whymper*).

Teuthraustes nitescens, sp. n. (Fig. 4.)

Colour as in the above.

Closely allied to *T. monticola*, from which it scarcely differs in any characters other than those enumerated in the table.

Total length 63 millim.; length of carapace 8, of tail 32; width of first segment 4·3, of vesicle 3·5; width of hand 6; length of movable digit 7·5.

Loc. Cachavi, in Ecuador (*Rosenberg coll.*).

The species of this genus known to me may be recognized as follows:—

- a. Hand very wide, its width exceeding the length of the movable digit; digits short, the immovable triangular, its basal width nearly equal to its length *latimanus*, sp. n., ♂.
(Corazon, 12,000 feet.)
- b. Hand narrower, its width less than length of movable digit; digits longer, basal width of the immovable only about half its length.
 - a¹. More coarsely granular, the antecular portion of carapace and the portion of the postocular area on each side of the median groove coarsely granular; last sternite mesially granular; first caudal segment with a pair of median granular keels; vesicle considerably more globular. *monticola*, sp. n.
(Machachi, 9000–10,000 ft.)
 - b¹. Less granular, antecular portion of carapace and its posterior median area nearly smooth; last sternite almost smooth in the middle; vesicle narrower, more elliptical *nitescens*, sp. n.
(Cachavi, 500 ft.)

Judging by the figures published by Becker of the two previously described species of this genus, namely *T. atramentarius*, Sim. (Ann. Soc. Ent. France, 1878, p. 400), from Quito, and of *T. ecuadorensis*, Becker (Ann. Soc. Ent. Belg. xxiv. p. 142, 1880), from Pensagui, Imbabura, 8000 feet, these two species fall under the heading *b* of the above table. Again, according to Becker's description, the tergal plates of the abdomen in *atramentarius* and *ecuadorensis* are "finement pointillés," and not "granuleux." If there is no error of observation involved in this statement, the two species are quite distinct from the forms described by me. Moreover, *ecuadorensis* appears further to differ from *atramentarius* in having the legs red instead of black, and the lower surface of the vesicle granular instead of punctured.

LXV.—*A new Freshwater Amphipod from New Zealand.*

By CHARLES CHILTON, M.A., D.Sc., F.L.S.

[Plate XVIII.]

THE Amphipod described in this paper was first found some years ago in a mountain stream on the slopes of Mount Mihiwaka, near Port Chalmers, New Zealand, at a height of about 1000 feet above sea-level. Afterwards I found it in numerous other streams in the neighbourhood, and also at Waitati, at various heights from about 200 feet above sea-level up to an altitude of 1500 feet. Since then Mr. G. M. Thomson tells me that his sons have collected it for him from a small dam at a hillside stream at Hopehill, Taieri, from spongy moss near the top of Mount Cargill, 2200 feet, and from similar ground on the top of Swampy Hill, 2400 feet.

Further investigation will probably show that it is widely distributed in similar situations in the eastern parts of Otago and perhaps elsewhere.

I have usually found it in the damp moss &c. on stones and boulders over which water trickles at the side of the stream, and often in association with the freshwater Isopod *Idotea lacustris*, var. β^* .

The occurrence of this Amphipod was briefly referred to in my paper on the "Subterranean Crustacea of New Zealand" †; but no description has hitherto been published. I refer it with some slight hesitation to the genus *Hyaella*, numerous species of which are found in the fresh waters of both North and South America.

Hyaella mikiwaka, sp. n.
(Pl. XVIII. figs. 1-12.)

Specific Description.—*Male* (fig. 1). Body stout and broad, especially in the pereion, smooth. Eyes small, round. Side-plates of the first four segments of the pereion much deeper than their respective segments, the fourth much broader than any of the preceding. First three segments of pleon with the lower posterior angles nearly right-angled, very slightly produced backwards. Telson simple, fairly large, convex, subrectangular, posterior angles rounded, hind margin very slightly produced in the middle.

* See 'Transactions New Zealand Institute,' xxiv. p. 263.

† Trans. Linn. Soc. 2nd ser., Zool. vol. vi. part 2, p. 254.

Antennæ subequal; peduncle of upper antenna as long as the flagellum, reaching to the middle of the last joint of the peduncle of the lower, which is slightly longer than its flagellum. First gnathopoda with the carpus as long as the propodos, its posterior margin bearing a regular row of about fifteen long setæ, which increase in length distally; propodos subrectangular, widening distally, palm nearly transverse, well defined by a knob formed by a projection of the posterior margin. Second gnathopoda with the ischium, meros, and carpus all small, subequal, the carpus not produced into a lobe; the propodos very large, about as long as the basos, rectangular, attachment to carpus narrow, both margins straight and free from setæ; palm nearly transverse, defined as in the first gnathopod, slightly convex, bordered by one or two irregular rows of short setæ of varying lengths; dactylos stout, with a slight projection on the inner margin near the base. Last three pairs of pereopoda with the basos very broad, its posterior margin very convex, minutely serrate. Third uropoda very minute, peduncle indistinct, apparently fused with its segment, the single ramus pear-shaped and bearing a few minute setæ.

Female. Differs from the male in the second gnathopoda, which are like the first in shape and size, but have the carpus shorter, subtriangular, with the row of setæ more oblique and containing only about five or six setæ.

Colour. Greyish or nearly white.

Size. Largest specimens about $\frac{1}{2}$ of an inch (5 millim.).

Habitat. Mountain streams near Port Chalmers, up to about 1500 feet above sea-level (*Chilton*). In hillside stream at Rast Taieri; from spongy moss at top of Mount Cargill, 2200 feet, and on Swampy Hill, 2400 feet (*G. M. Thomson*).

Remarks. This species appears to be very distinct and easily distinguished from the other species of the same genus of which I have descriptions at my command. The chief distinguishing points seem to be:—

- (1) The body is stout and broad and the side-plates deep.
- (2) The lower antennæ are only slightly longer than the upper; usually they are much longer.
- (3) The gnathopoda are very characteristic, especially in the regular row of setæ on the carpus of the first and in the very large rectangular propodos of the second. In neither is the carpus produced into a lobe lying alongside the base of the propodos.
- (4) The third uropoda appear more rudimentary than in most of the species.

In addition to the description given above, I add the

following particulars regarding some of the appendages, those appendages which are not mentioned being understood to present no features calling for special mention beyond the description already given.

Upper lip firm and strong; distal margin regularly rounded and nearly semicircular, covered with a fur of fine setæ converging towards the centre.

First maxilla. Outer lobe strong, with the usual strong denticulate setæ at the end; inner lobe small and very slender, with two long plumose setæ at the extremity. On the outer margin of the outer lobe is a slight notch, indicating the position of the rudimentary "palp," but I can find no trace of the palp itself.

Maxillipedes (fig. 4) fairly large and well developed. The inner lobe is long, reaching as far as the end of the outer lobe; it is oblong, and the extremity, which is slightly oblique, bears, in addition to some fine setæ, three rather blunt teeth, of which the innermost one is the smallest and the outermost one the largest; the outer lobe has the inner margin nearly straight and fringed with fine setæ, the outer margin curved and without setæ except at the extremity; the meros has one or two setæ at the extremity on each margin; the carpus is broad, being produced on the inside into a flat expansion densely fringed with fine setæ; propodos much narrower than the carpus, slightly curved, margins parallel, the extremity bearing numerous fine setæ; the dactylos small, partially imbedded in the propodos, the extremity bears several setæ, one of which is much longer and stronger than the others.

First gnathopod (fig 5). The general form will be sufficiently understood from the figure and the description already given. The well-marked row of long setæ on the carpus is on the outer portion of the posterior margin, which is slightly produced into a flat expansion; a few setæ are irregularly placed on the inner surface of the propodos.

Second gnathopod. The difference in the form and size of this appendage in the two sexes is very marked. Fig. 7, which represents the inner side of the appendage in the female, shows that there is a small tuft of two setæ present on the inner surface of the carpus in addition to the row of setæ on the posterior margin.

Uropoda (figs. 9, 10, 11). The first and second pairs of uropoda are well developed and present no remarkable features; the third are rudimentary and very minute, the only part that can be easily made out being that shown in fig. 11, which appears to represent the single ramus; it is

pear-shaped, and bears on the outer margin a small tuft of fine setæ at the centre and another at the extremity; the inner margin is without setæ; the peduncle appears to have coalesced with the sixth segment of the pleon.

EXPLANATION OF PLATE XVIII.

Hyalella mihiwaka.

- †
Fig. 1. Side view of male, $\times 19$.
Fig. 2. Upper antenna, $\times 45$.
Fig. 3. Lower antenna, $\times 45$.
Fig. 4. Maxillipedes, $\times 45$. 4a. Inner lobe, $\times 120$. 4b. Extremity, $\times 120$.
Fig. 5. First gnathopod, $\times 45$.
Fig. 6. Second gnathopod of male, $\times 45$.
Fig. 7. Second gnathopod of female, $\times 45$.
Fig. 8. Pleon, $\times 45$.
Fig. 9. First uropod, $\times 45$.
Fig. 10. Second uropod, $\times 45$.
Fig. 11. Third uropod, $\times 45$.
Fig. 12. Telson, $\times 85$.

LXVI.—*New Coccidæ from Mexico.* By T. D. A. COCKERELL, Entomologist of the New Mexico Agricultural Experiment Station.

THE Coccidæ herein described were collected in Mexico in 1897 by Mr. A. Koebele and Prof. C. H. T. Townsend, and sent to the U.S. Department of Agriculture. I am much indebted to Dr. L. O. Howard, the Entomologist of the Department, for the opportunity of studying and describing these insects, which prove to be many of them of extreme interest.

It is proper to state that Mr. Koebele's expedition was made at the expense of the government of the Sandwich Islands, while Prof. Townsend's collecting was done in the service of the United States.

POROCOCCUS, gen. nov.

Allied to *Solenophora*. Female with antennæ and legs. Antennæ 6-segmented, the last segment long. Caudal tubercles not much produced. Anal ring with 6 bristles. Insect contained in a black scale, which has an orifice at the hind end. Embryonic larva with rows of spines as in *Eriococcus* &c.

Type *P. tinctorius*.

Porococcus tinctorius, sp. n.

♀.—Scales crowded on twigs, *Kermes*-like, pitch-black, hard, slightly shiny, $2\frac{1}{2}$ – $3\frac{1}{4}$ millim. diam., very convex, globular, with the caudal end projecting like the neck of a flask, with quite a large opening directed upwards. Sometimes there is a strong protuberance on each side of the scale.

♀.—Placed in caustic potash, without boiling, gives at once a dark cherry-red colour, blackish in thin solutions; on boiling it gives the most intense madder-colour, extremely dark, stronger than cochineal. On adding HCl to the alkaline solution it turns to a rather light claret-colour, and a precipitate appears. After boiling pyriform, with a pale purple tint, as though stained with logwood. Abdominal segmentation rather obscure; except the last four segments, constituting a narrowed caudal portion, which are very distinct and (especially the last two) brownish, becoming chitinous. Dermis crowded with small round glands, some simple, but most with three orifices close together, appearing as one under a low power. Mouth-parts well developed. Antennæ and legs pale yellowish; antennæ 6-segmented, formula 6 3 2 (5 1) 4; the sixth is quite long, like that of a Dactylopiid. Tibia barely longer than tarsus; claw large, gently curved; all the digitules filiform. Caudal tubercles not much produced, each with a strong bristle; anal ring with six light brown, very long, and very stout bristles. The tissue of the scale is invaded by the mycelium of a fungus, and the female itself suffers from a dipterous parasite, *Leucopis* or an allied form.

Hab. Ameca, Mexico, June 7, 1897, on mistletoe on oak (*Koebele*, 1748). Div. Ent. 7909.

Porococcus Pergandei, sp. n.

♀.—Scales on twigs, 2 millim. long, of the same pitch-black colour and hard texture as *P. tinctorius*, but shape quite different. They are elevated, with a high longitudinal crest, presenting three conspicuous nodular prominences, which are sometimes deflected to one side; in transverse section the scale is triangular. Posteriorly the scale is not produced, and the orifice is filled in with lamellæ of brownish-white secretion, arranged so as to resemble an aster-flower. From the nodules of the crest there run blunt ridges down the sides of the scale. The scales do not crowd together as in *P. tinctorius*.

The insects placed in caustic potash without boiling give a lilac colour; boiled, they give a dark purple.

♀ (containing embryos) similar to *P. tinctorius*, but smaller. Anal ring with 6 bristles. Caudal and dermal structure and form of body as in *tinctorius*; antennæ 6-segmented, formula 6 3 2 5 (14), but there is a very marked false joint, dividing 3 just beyond its middle, and another at the end of the basal third of 6, so that the antennæ seem to be 8-segmented. Legs tinged with brown, resembling those of *tinctorius*; trochanter with a long hair. Embryonic larva more than twice as long as broad, with very minute spines or bristles arranged in rows after the manner of *Eriococcus*.

Hab. Cuautla, Mexico, May 31, 1897, on mistletoe on lime (*Koebele*, 1738). Div. Ent. 7919.

Named after Mr. T. Pergande, of the Department of Agriculture, who looked at the specimens before they were transmitted to me, and recognized them as belonging to a new genus.

PROTODIASPIS, gen. nov.

A genus of Diaspinæ secreting no distinct scale, but the females enveloped in cottony secretion, the male pupæ resembling those of *Diaspis*, but extremely short. No grouped circumgenital glands.

Type *P. parvulus*.

Fiorinia syncarpiæ, Maskell, possibly belongs to the same genus.

Protodiaspis parvulus, sp. n.

♀.—Very small, little over $\frac{1}{2}$ millim. long, enclosed in irregular white cottony secretion; exuviae light yellow.

♀.—Bright yellow, colourless after boiling in KHO; broad oval or nearly circular; skin with numerous small round glands; mouth-parts large, rostral loop short; on each side of the mouth-parts is, on a rounded patch, what I take to be a stigmatic orifice, and also a group of about eleven round glands resembling the circumgenital glands of *Diaspis*; anterior to the mouth-parts are two nearly circular structures which may be rudimentary antennæ; abdomen with six very distinct segments, exclusive of the terminal piece, which is not very large; anus very distinct, a fair distance from the hind end, the skin round it strongly concentrically striate; hind margin broad and flattened, not at all produced, with four very low, broad, rounded, colourless lobes, well apart, their edges inclined to be crenulate; very small spines, but no spine-like plates.

♂.—Scale white, *Diaspis*-like, with pale yellow larval skin at one end. The scales are very minute, and the projecting white portion is not as long as the larval skin.

Hab. Amecameca, Mexico, June 6, 1897, on bark of oak (*Koebele*, 1753). Div. Ent. 7965.

A most interesting insect, connecting the Diaspinæ with the Coccinæ.

Solenophora Koebelei, sp. n.

Near to *S. corokiae*, Mask., but much larger. The oldest females are in a rounded dull black scale, 5 millim. long, $4\frac{1}{2}$ broad, and 3 high, the hind part hardly produced. On breaking this open one finds the shrivelled body of the female lying loose within, with a mass of yellowish-white empty egg-pellicles. The dried female has a dark purplish tint. In the penultimate stage the test or scale is from 3 to $4\frac{1}{2}$ millim. long, broadly oval in outline, flat or even depressed in the middle when dry, with a blunt dorsal keel or row of protuberances, on each side of which is a subdorsal row of protuberances, often inconspicuous. Margin convex, raised, more or less nodular, with three white transverse lines of secretion about the middle. Caudal end with the usual orifice, but hardly at all produced.

♀.—Anal lobes and ring (with six hairs) as in Maskell's figure of *corokiae*; skin crowded with short rod-like processes; mouth-parts small but well-formed; no legs or antennæ; on the abdomen on each side of the middle line are two large oblong brown patches, close together, the anterior of each pair the larger, their surface granular or minutely reticulated.

♂.—Scales small and elongate, reminding one of those of *Tuchardia*; dark in colour, with a red tint, or sometimes more or less yellow. Their inner surface is pale yellow.

Hab. Tulare, Mexico, Aug. 8, 1897, on *Cratægus* and *Prunus demissa* (*Koebele*, 1659). Div. Ent. 7891. Also on *Cratægus* from Mexico (locality and date not stated: *Koebele*, 1632).

The discovery of *Solenophora* in Mexico is most remarkable, as the genus has hitherto been known by only two species (both of which are before me) from New Zealand.

Icerya (Proticerya) littoralis, sp. n.

♀.—About 3 millim. long, with sac 10 millim.; breadth of sac nearly 4 millim. Dorsum entirely covered by snow-white secretion; some irregular lateral cottony tassels. Ovi-Ann. & Mag. N. Hist. Ser.

sac white, distinctly tinged with yellow on its basal half; distinctly ribbed, but the ribs weak and flattened.

♀.—Boiled in KHO gives a crimson colour. Antennæ and legs dark brown; antennæ 9-segmented, 9 longest and about as long as 6, 7, and 8 together; 2 and 3 subequal; 4 to 8 subequal and shortest. Segments with whorls of bristles, two of those on 8 very long, extending beyond tip of 9; two hairs on 9 are much longer than itself. Coxa with a whorl of apical bristles; trochanter with about six short bristles and one long one; femur moderately bristly, several erect bristles on its inner side; tibia slender, rather longer than femur, with three or four long bristles on its outer side and about ten pairs of short stout ones on the inner; tarsus about half as long as tibia, curved; claw stout. Skin sparsely beset with hairs and presenting numerous small round glands.

Larva with six very long caudal bristles, and six long curved bristles on each side anterior to them.

Hab. El Faro, near Frontera, Mexico, on *Croton* on the sea-beach, on the sandy ridges just beyond the reach of ordinary surf; May 16, 1897 (*Townsend*). Div. Ent. 7636.

Iceya littoralis, var. *mimosæ*, var. nov.

Characters of *I. littoralis* in general. Boiled in KHO gives a deep raspberry colour. Antennæ 9-segmented, but 9 only a little longer than 7+8. Ovisac about 8 millim. long, like that of *littoralis*, but all the secretion of both female and ovisac a delicate primrose-yellow.

Hab. Las Minas, near Frontera, Mexico, June 4, 1897, on "Sarsa," *Mimosa*, sp. (*Townsend*). Div. Ent. 7816.

Ortonia mexicanorum, sp. n.

♀.—Under cover-glass about 6 millim. long. The dried insects are oval, dark grey, more or less mealy, often densely so, with two curled white cottony caudal filaments, nearly 4 millim. long. Boiled, the insects turn the liquid sherry-colour and themselves become dark mulberry-red, stained with blackish on the abdominal dorsum, but without black spots.

Antennæ and legs dark sepia-brown; antennæ about as long as femur+trochanter, 10-segmented, 10 about as long as, or a little longer than, 8+9, all the segments except 10 broader than long, each with a conspicuous whorl of strong bristles. Formula approximately 10 (3 2 1) 6 (7 9 8) (4 5); 4 and 5 are conspicuously shorter than 3 or 6; 2 is sometimes

distinctly longer than 3, 1 is nearly twice as broad as 2. Coxa large, trochanter with numerous strong bristles, one longer than the rest; femur stout, with numerous short but strong bristles and spines; tibia about as long as femur, but only about half as broad, the distal two-thirds on the inner side beset with 8 pairs of short but strong spines; tarsus about two thirds length of tibia, with five pairs of spines on the inner side; claw very long, thick, gently curved, no knobbed digitules; in place of the claw-digitules are two slender bristles; skin colourless after boiling, delicately striated, thickly beset with small round glands, between which are minute hairs, not enough to make a definite pubescence. In the abdominal region are a number of large round and oval hyaline spaces, definitely circumscribed and having the appearance of a nucleus and nucleolus in the middle; these spaces are free from the small glands. Mouth-parts well-developed.

Cast skins of immature forms thin, white, suboval, 5 millim. long, 4 broad, with antennæ and legs attached. They occur on the twigs.

Hab. Misedac (?), Mexico, Aug. 13, 1897, on *Acacia Greggii* (?), a thorny plant (*Koebele*). Div. Ent. 7877.

With them occur certain large ($9\frac{1}{2}$ millim. long) Coccinellid larvæ, which look just like old females of *Ortonia*.

Kermes grandis, sp. n.

♀.—Globular, 10 millim. diam., not visibly segmented, surface dull; peppered or marbled with black, grey, and white. With a lens the white areas are seen to be thickly sprinkled with minute brown spots. The black and brown marbling is quite irregular.

Hab. Amecameca, Mexico, May 25, 1897, on *Quercus Engelmanni* (*Koebele*, 1756). Div. Ent. 7920.

Only one specimen is available for study; but the species is very distinct; nearest to *K. galliformis*, Riley.

Tachardia fulvoradiata, sp. n.

♀.—Scale hemispherical, diameter about $3\frac{1}{2}$ millim.; two or more often united; middle of dorsum somewhat depressed and corrugated; sides with six irregular foot-like processes; colour of scale dark orange-brown, varying in parts from light orange to black; three light reddish-orange bands or stripes start from the centre and pass down the sides between the lateral processes.

Boiled in KHO the female gives a fine crimson-lake. Anal cone ordinary, with about nine not very long terminal hairs; spine rather short; excretory tubes with very numerous pores.

Hab. Rancho Carbonel, near Frontera, Mexico, on a large tree called "Palo de gusano," June 4, 1897 (*Townsend*). Div. Ent. 7804.

Inglisia malvacearum, sp. n.

♀.—Scale 7 millim. long, $3\frac{1}{2}$ broad, only moderately convex, general shape oblong, snow-white, very conspicuous; presenting on the dorsal surface two large conical (patelli-form) plates and on each side about four similar but lower plates, not well separated from each other; posteriorly the plate-structure gives way to a fibrous substance resembling the tissue of the ovisac of a *Lichtensia*. The plate-structure cannot be described in great detail, because it is more or less irregular and quite variable within certain limits. The plates appear to be joined together by the fibrous matter.

♀.—Dermis after boiling colourless, with small round glands; margin with a row of brownish spines, short but stout, blunt-tipped, on the average about as far apart as the length of one. Antennæ and legs well developed, yellowish; antennæ of the ordinary Lecanid type, long and slender, 8-segmented, 3 considerably the longest, formula 3 5 4 (2 6 7 8) 1 or 3 5 (4 2 6 7 8) 1; 5 has a pair of bristles, one very long, near its end; 8 has several bristles. Legs moderately slender; coxa long, with two anterior and one posterior apical bristles; trochanter with a large and a small bristle near its apex; femur with anterior and posterior subapical small bristles; tibia not much shorter than femur; tarsus about $\frac{2}{3}$ length of tibia; claw short and much curved; claw-digitules rather stout, very short, not so long as claw; tarsal digitules apparently absent. These details were from an anterior leg; a hind leg showed digitules of claw stout, well-knobbed, extending beyond claw, and tarsal digitules filiform but strong, quite long, with well-formed knobs. Anal plates yellowish brown, of the usual form, postero-lateral side a little longer than antero-lateral, surface armed with about five bristles. Anal ring with seven hairs. Mouth-parts rather small.

The conical protuberances of the scale are glassy, concentrically striate, with the usual air-cells of *Inglisia*; the lateral portions of the scale have a fibrous structure.

♂.—Scale glassy, small, resembling the ordinary male scales of *Lecanium*.

The insects are considerably parasitized by a *Leucopis* or allied fly.

Hab. Morelos, Mexico, on *Malva*, May 29, 1897 (*Koebele*, 1624). Div. Ent. 7884. Also collected by *Koebele* at Cuautla, Mexico, July 1 and 2, 1897, on *Hibiscus* and cotton.

Lecanium Townsendi, sp. n.

♀.—Scale $5\frac{1}{2}$ millim. long, $4\frac{1}{2}$ broad, $3\frac{3}{4}$ high; hemispherical, shiny; ground-colour chrome-yellow, very thickly bestrewn with minute black dots; larger black pits at intervals; round the margin and in the anal region the surface is entirely black; margin much pitted; a fine, not quite continuous, blackish, mid-dorsal longitudinal streak; posterior cleft quite long.

Boiled in KHO turns the liquid madder-brown. Dermis chitinous, clear yellow by transmitted light, with very numerous small oval glands. The females studied are full of eggs. Mouth-parts extremely small. Legs and antennæ mere colourless rudiments, not well observed. Stigmatal spines very small.

Embryonic larva ordinary, yellow to reddish brown, with minute hairs; claw long, four long filiform digitules.

The scales are badly attacked by a lepidopterous larva. Small mites occur on or in the scales.

Hab. Frontera, Tabasco, Mexico, June 26, 1897, on orange-trees (*Townsend*). Div. Ent. 7806.

Allied to *L. punctatum*, Ckll., but considerably larger.

Aspidiotus (Chrysomphalus) albopictus, sp. n.

♀.—Scale circular, flat, diam. $2-2\frac{1}{4}$ millim., very dark brown, nearly black, but appearing white unless rubbed, because covered with a chalky-white secretion, leaving the exuvix as a large round dark brown spot away from the centre. Younger scales are brown, with the exuvix darker, even black, the first skin marked by a pale ring, the second narrowly margined with ochraceous. Still younger examples are orange-fulvous, with a semitransparent whitish margin. Male scales suboval to pyriform, coloured like the submature female scale, viz. dark brown, with the larval skin black or blackish, or else white like the mature female.

♀.—Of ordinary form, but the caudal end narrow and quite pointed; colour pale yellowish after boiling. Four groups of circumgenital glands, caudo-laterals 6 to 7, cephalo-laterals 8 to 9. Tubular processes at bases of lobes as in the subgenus, long; four pairs of the longer ones, the inner four with

their ends at the same level. Lobes ordinary, well apart, median ones small, with nearly the outline of a half-circle; second twice as broad as first; third fully three times as broad as first, with the edge minutely serrulate; beyond the third lobe the margin is very minutely serrulate, and there are three distinct notches marking the limits of four broad rudimentary lobes. Anal orifice a long distance from hind end. Mouth-parts very large.

The specimens are infested by a fungus.

Hab. Cuernavaca, Mexico, on leaves of orange, Dec. 8, 1897 (*Townsend*). Div. Ent. 7935.

Ceroplastes minutus, sp. n.

♀.—Scale $1\frac{1}{2}$ millim. long, broad-oval, convex, pale yellowish, the dorsum thickly covered with bright lemon-yellow wax, forming a large protuberance; plates not defined. Scales solitary on the twigs.

♀.—When denuded of wax yellowish brown, depressed, with a dorsal protuberance, and a large and thick but short terminal horn. Antennæ very pale, segments obscure, but apparently seven; antennæ very close to the mouth-parts, almost touching them; mouth-parts large, brown, rostral loop reaching to anal ring; legs very pale, ordinary; tibia little longer than tarsus, claw long, digitules rather stout. Dermis after boiling transparent, non-chitinous, with many small round glands; stigmata on large yellowish-brown chitinous patches; anal area yellowish brown, chitinous, the large chitinous portion abruptly defined from the rest; anal plates large and well developed.

Hab. Las Minas, Tabasco, Mexico, June 2, 1897, on "Escobillo," a wild shrub (*Townsend*). Div. Ent. 7185.

Very distinct by its small size and other characters.

Ceroplastes angulatus, sp. n.

♀.—Scale 5 millim. long, $4\frac{1}{2}$ broad, 4 high; very convex, wax snow-white, shining, not divided into plates; dorsal nucleus dark, more or less covered by secretion; no lateral nuclei visible, but anal plates exposed; on each side the margin is produced into two prominent angles, to the tips of which, beneath, run lines of chalky secretion; these angles represent the rays of *Vinsonia*, to which the species makes an approach.

A very young individual is elongate-oval, bright yellow, covered with transparent wax; dorsal knob of wax transversely grooved-striate.

Hab. Frontera, Mexico, on twig of native tree in woods (Townsend). Div. Ent. 7614.

There is only one adult female available for study, but the species is very distinct, being intermediate between *Ceroplastes* and *Vinsonia*.

Ceroplastes coloratus, sp. n.

♀.—Scale $4\frac{1}{2}$ millim. long, $3\frac{1}{2}$ broad, 3 high; wax irregular, nodulose, not divided into plates, pale yellow; dorsal nucleus dark, not conspicuous. When the scales are getting old the surface of the body is exposed in the subdorsal region. Scales solitary on twigs.

♀.—Denuded of wax, 4 millim. long, 3 broad, $2\frac{1}{2}$ high; dark chestnut-brown; dorsum convex, smooth, sides irregularly wrinkled, with a pair of emarginate (stigmatal) prominences close together. Caudal horn stout and distinct, not very long. Boiled in liquor potassæ the insects give a fine crimson colour. Skin feebly chitinized, transparent, with round gland-spots on small brownish spots; stigmatal and anal areas and much of back very strongly chitinized, sienna-brown; legs ordinary, tibia and tarsus of nearly equal length; antennæ brownish, 8-segmented.

Hab. Las Minas, Tabasco, Mexico, June 2, 1897, on "Crucetilla," a small wild spiny shrub (Townsend). Div. Ent. 7814.

Nearest to *C. irregularis*. Peculiar for the crimson colour it gives on boiling.

Lichtensia crescenticæ, sp. n.

Ovisac, covering female, about 6 millim. long and $3\frac{1}{2}$ broad, loose in texture, but not adhering to objects that touch it; on the surface greyish white, with a distinct yellowish tinge; inclined to be longitudinally striated.

♀.—Antennæ pale yellowish, 8-segmented, rather slender; 3 much longest, about as long as 4+5. Formula 3 (4 2 5) 1 (6 7 8); 2 with two long hairs near its end. Another shows the antenna with segment 3 not nearly as long as 4+5, and formula 3 4 (5 2 1) 6 8 7. Anal plates reddish brown, obliquely pyriform; skin with numerous small tubular glands; stigmatal spines in threes, all short, stout; marginal spines numerous, of moderate length, stout, closer together than the length of one, often closer than half that length. Coxa and trochanter each with a subapical bristle; legs rather short; tarsus rather more than half length of tibia; claw short and curved; claw-digitules stout, extending a little beyond claw,

gradually widening to a sort of trumpet-like extremity; tarsal digitules only moderately long, not twice length of claw.

Hab. Frontera, Tabasco, Mexico, June 26, 1897, on "Guanabano" (doubtless *Crescentia*), a cultivated tree with gourd-like fruit (*Townsend*). Div. Ent. 7980.

Lecanium (Saissetia) castilloe, sp. n.

♀.—Scale 8 millim. long, 7 wide, flat, with an irregular broad-oval outline, dull; black, with a minute peppering of whitish patches of secretion, most abundant towards the sides, where they give the scale a greyish tint. The sides of the scale are perpendicular, about 1 millim. high, the edge of the dorsal portion slightly overlapping at the top, like the roof of a house. Posterior cleft about $2\frac{1}{3}$ millim. long.

Skin extremely thick, resisting prolonged boiling in caustic potash; by transmitted light dark vandyke-brown, tessellated as in *Saissetia*, each small polygon with a central hyaline spot. Legs pale yellowish, small, slender; coxa and trochanter each with a subapical bristle; tibia very slender, not quite so long as femur; tarsus about $\frac{2}{3}$ length of tibia; claw moderate, curved; claw-digitules stout but long, extending considerably beyond claw, well knobbed.

Hab. Frontera, Tabasco, Mexico, June 25, 1897, on bark of trunk of *Castilleja elastica*, also on "Moral" (*Townsend*). Div. Ent. 7981.

A remarkable species, quite distinct in outward form from all described.

Lecanium (Pseudokermes) armatum, sp. n.

♀.—Scale $4\frac{1}{2}$ millim. long, $4\frac{1}{2}$ wide, 3 high, hemispherical, greenish yellow to yellowish brown, with a very thin and easily deciduous glassy coating, present only in fragments in the specimens seen. Anal area depressed and darkened. The scale is divided into convex plates or areas, two very large ones subdorsally and seven laterally, on each side; each of these convex areas presents in the middle a small conical prominence. Margin thickened.

♀.—Boiled in liquor potassæ gives a dark brown colour. Skin chitinous, with rather large and numerous round glands; towards the margins the skin is obscurely reticulated, in *Eulecanium* fashion. The dermis exhibits numerous large low-conical elevations. Legs and antennæ apparently absent.

♂.—Scales small, overlapping, with a glassy covering as usual in *Lecanium*.

Hab. S. Francisco del Peal, Tabasco, Mexico, July 1, 1897, on "Palo de gusano" (*Townsend*). Div. Ent. 7978.

The species is badly attacked by a lepidopterous larva. This is the second *Pseudokermes*, the first being from Brazil.

Diaspis phoradendri, sp. n.

♀.—Scale rather over $1\frac{1}{2}$ millim. diam., circular, snow-white, moderately convex; exuviae somewhat to one side, exposed, orange-brown to dark brown, second skin covered with a layer of secretion in fresh specimens; surface of first skin cancellate.

♀.—After boiling circular, colourless, the caudal end and median lobes strongly tinged with yellowish brown; small sac-like structures at bases of lobes resembling those of *Diaspidiotus*, a closely adjacent pair beneath median lobes, and three or four other pairs at intervals along the margin; median lobes close together, low, evenly rounded, entire; second and third lobes represented by extremely small, colourless, pointed prominences; spines large; spine-like plates large, two on each side especially large and broad, with fimbriated ends; anal orifice not very far from the hind end, far posterior to the level of the postero-lateral glands; five groups of circumgenital glands, median of 11, antero-laterals 10, caudo-laterals or postero-laterals 3 to 4.

♂.—Scale minute, of the usual form, with only a bare indication of a median keel.

Hab.—Cuautla, Mexico, May 31, 1897, on mistletoe, doubtless *Phoradendron* (*Koebele*, 1749). Div. Ent. 7960.

The female scale is more convex than that of *D. visci*, and a more opaque white; the exuviae are browner.

Aulacaspis miranda, sp. n.

♀.—Scale $1\frac{1}{4}$ millim. diam., flat, irregularly subcircular to subtriangular, black, with a sort of whitish bloom, extreme margin whitish; exuviae lateral, very pale yellowish.

♀.—After boiling in liquor potassæ pale yellow. Median lobes wide apart, minutely serrated, striated, produced, but not conspicuously, beyond the margin; two spine-like plates in the interval between them; second and third lobes each divided into three small lobules; spine-like plates, extending considerably beyond the lobes, cephalad of the second and third lobes; fourth lobe represented by two prominences, the second larger and serrate; beyond this is a short, stout, spine-like plate, then a low prominence, and beyond, at intervals, four short, stout, spine-like plates. Five groups of circum-

genital glands, median of 11, anterior laterals 18, posterior laterals about 8.

♂.—Scales obscurely tricarinate, but very fluffy, looking like little fluffy white spots of no particular shape.

Hab. Cuautla, Mexico, July 25, 1897, on Cherimoya; also Cuautla, Sept. 27, 1897, on "Zapote" (*Koebele*, 1658). Div. Ent. 7890. Also Orizaba, July 19, 1897, on "Zapote" (?) (*Koebele*, 1736). Div. Ent. 7944.

The scales occur upon the leaves. Very distinct by the black female scale &c.

Mytilaspis mexicana, sp. n.

♀.—Scale pale brown, dull, flat, so broad as to be almost circular, the pointed basal end sometimes curved to one side. Diam. 3 millim., length $3\frac{1}{2}$ millim. Exuviae brown, of a darker tint than the scale, second skin covered.

♀.—After boiling colourless, the caudal portion strongly striated longitudinally, and suffused with yellow. Median lobes large, a short distance apart, the inner margins parallel, the apex rounded, the outer declivity long and twice notched; second lobes small, completely divided into two lobules, of which the outer is the smaller; third lobe similar, but only one distinct lobule; beyond the third lobe are three broad serrated eminences, representing rudimentary lobes; plates spine-like, stout, and rather long; many transversely linear dorsal glands; some structures like the interlobular thickenings of *Diaspidiotus*, but below instead of between the lobes. Five groups of circumgenital glands, median of 18 to 25, anterior laterals about 27 to 33, posterior laterals 25 to 35.

♂.—Scale elongate, of the form usual in the genus.

Hab. Cuautla, Mexico, on "Nettle-tree," July 2, 1897 (*Koebele*, 1724). Div. Ent. 1763. Also collected by *Koebele* at Cuautla on "Dragon's Blood" (?) and on roots of *Ficus*, sp. (?), many of the last-mentioned lot being parasitized.

The form and appearance of the scale at once distinguish this from all other American forms.

In the collection are also specimens of *Mytilaspis* (subg. *Opuntiaspis*, Ckll., MS.) *philococcus*, Ckll., marked "On cactus, Mexico, Aug. 2, 1897" (*Koebele*, 1695). Div. Ent. 5860.

Aspidiotus (Pseudodiaspis) dentilobis, sp. n.

♀.—Scale oval, about $2\frac{1}{2}$ millim. long, convex, with the exuviae lateral but within the marginal limits, at one end; colour of scale black, with more or less greyish and whitish

concentric strigation, the margin often quite white; exuviae large, first skin at margin of second, second skin more or less covered by blackish secretion, or more often exposed; the two skins of the same colour, a very deep orange.

♀.—Colourless and transparent after boiling, except the whole caudal portion, which is striate and chitinized, and remains yellowish brown. No groups of circumgenital glands, but numbers of small dorsal glands; the four median lobes resembling human incisor teeth, *i. e.* broad and squared at the end, but separated by distinct intervals, and the second lobes hardly over half the length of the first, though not much less broad; third lobe represented by a pair of angular prominences, separated by a wide interval from the second; beyond this the margin shows large irregular crenations. Spines quite large; spine-like plates beyond second and third lobes quite large and broad, as in *Diaspis*. The females contain extremely large embryos, which remain sepia-brown after boiling, as in *A. larreæ*; they show intensely dark eyes and 6-segmented antennæ, in which 3 and 6 are much longest, 3 longer than 4+5, 2 shortest of all.

♂.—Scale in texture like the female, but elongate, with the larval skin at one end.

Hab. Cuautla, Mexico, May 31, 1897, on a spiny wild shrub (*Koebele*, 1751). Div. Ent. 7947. Also found by Koebele at Cuautla on *Mimosa*, and on an *Acacia* (?) with yellow flowers and long spines (*Koebele*, 1696).

This is the second known species of *Pseudodiaspis*.

Aspidiotus (Chrysomphalus) longissimus, sp. n.

♀.—Scale linear, $2\frac{1}{2}$ millim. long, $\frac{3}{4}$ millim. broad, black, more or less marked with brown, or even becoming whitish or actually dull white from a coating of secretion. A thin white ventral scale. Exuviae at one end, nearly circular; second skin black, with more or less of a reddish-orange edge; first skin represented by a small low nipple-like structure, in fresh specimens showing a distinct pale dot and ring.

♀.—Characters practically as in *A. Bowreyi*. Three pairs of lobes, successively larger from the first to the third, the largest (third) with two little notches on its broad outer edge; three serrations on the margin beyond the third lobe; anal orifice a considerable distance from the hind end; circumgenital glands present, median of 2, anterior laterals 5, posterior laterals 3, the lateral groups forming a nearly continuous row.

Lab. Frontera, Tabasco, Mexico, June 28, 1897, on leaves

of mango, together with a few *Aspidiotus personatus*, Comst. (Townsend). Div. Ent. 7973.

As Prof. Townsend remarks, this very curious little species resembles a lately-hatched lepidopterous larva. It is closely allied to *Aspidiotus Bowreyi*, Ckll. 1894, which must be added to the fauna of Mexico, as Prof. Townsend found it at Frontera on "Pitahaya," an edible cactus, June 5, 1897 (Div. Ent. 7831):

Aspidiotus (Chrysomphalus) calurus, sp. n.

♀.—Scale about $1\frac{1}{2}$ millim. diam., approximately circular, slightly convex, covered by the epidermis of the bark, except the shining black exuviae, which are exposed and very conspicuous. There is a thick ventral scale, which makes it very hard to extract the female.

♀.—After boiling, brownish yellow or yellowish brown; general form circular, but the caudal portion is narrowed on each side, produced and rounded, having a curious appearance. From the sides of this portion cephalad the margin is gently rounded until it reaches a deep notch, forming the further (anterior) wall of which is a large tooth-like projection; the cephalad side of this latter gradually slopes to another notch, beyond which is a rounded eminence. The last visible suture before the caudal portion is marked by a broken dark chitinous band. No groups of circumgenital glands; anal orifice some distance from hind end; two long and seven short pairs of tubular processes, the short ones considerably longer than the lobes; the innermost long ones further apart than either from the outermost. Four very well-formed pairs of lobes, the first rather narrow, pointed, with a notch on the outer margin; the second, third, and fourth broader and similar to one another, except that the second and third have two notches on the margin, while the third is minutely serrate. The median lobes are near to each other, but not touching, at the base; the intervals between the other lobes are wide, that between the third and fourth rather wider than a lobe. Beyond the fourth lobe the margin is crenate, with about five little prominences. Plates short and inconspicuous.

♂.—Scale brownish, with concolorous exuviae, with a small well-sculptured dot and ring.

Hab. Orizaba, Mexico, July 15, 1897, on *Cratægeus*, on the bark of the twigs (*Koebele*, 1727). Div. Ent. 7950.

A very distinct species, easily known by the form of the hind end of the female.

Mesilla Park, New Mexico, U.S.A.,
April 3, 1898.

LXVII.—Notes on the Beech-Martens of the Palearctic Region. By G. E. H. BARRETT-HAMILTON.

THROUGH the kindness of Mr. Abel Chapman I have been permitted to examine the skin and cranium of a marten from Andalusia. This specimen, though it agrees in general size and in cranial characters with *Martes foina*, is very distinct both from that animal and from *M. martes* in coloration, but is indistinguishable from specimens in the British Museum collection from Xanthus, in Asia Minor, and from Kandahar. In the Afghanistan region, however, there is another form—*M. leucolachnæa*—of which the British Museum collection possesses a specimen from Hazara, in Afghanistan, and a second from Vernoë, in Turkestan. Finally, a third form—*M. toufæa*—is represented in the same collection by specimens from Gilgit, Hunya (Cashmere), and from Tibet.

Probably all these forms intergrade with each other in the intermediate regions, and their treatment presents many difficulties, in illustration of which I need only quote the remark of Mr. W. T. Blanford*, that "probably the martens, like the cats, comprise a large number of incipient species, imperfectly differentiated. This is Severtzoff's view also." They may be treated as distinct species, or as varieties or subspecies of the typical *M. foina*, according to the individual preference of the investigator; but it will be useful to give a concise review of the characters by which they may usually be distinguished from one another.

General characters † (common to all the *foina* group).—Third upper premolar convex externally; external margin of the fourth upper premolar exceeding in length the transverse diameter of the single upper molar; external margin of hindmost tooth incurved and bilobed.

The subspecies are

Mustela foina, Erxleb.

(Syst. R. An. 1777, p. 458),

which has the throat-patch pure white, the fur close in texture and of a dark brown colour, the underfur greyish white, and the tail not bushy.

* 'Scientific Results of the Second Yarkand Expedition,' Mammalia, p. 29.

† For further details see Blasius, Säugeth. Deutsch. pp. 213–219, and R. Hensel, in Archiv für Naturgeschichte, 1853, pp. 17–22 (with plate).

Mustela mediterranea, sp. n.

which has the throat-patch * not pure white as in *M. foina*, but tinged with yellow and nearly as bright as that of a specimen of *M. martes* from Co. Kerry, Ireland (B. M. coll. no. 94. 3. 27. 1), though not nearly so bright as is the case with ordinary continental or British examples of the same species, the richest in this respect being one from Sardinia (B. M. coll. no. 95. 4. 16. 1). The general colour of the fur is not dark brown as in *M. foina*, but reddish brown, redder than in *M. leucolachnæa*, but resembling the colour of *M. toufæa*, from which species *M. mediterranea* may, however, be readily distinguished by the far lighter, nearly white, colour of the underfur. The colour of the tail is slightly darker than that of the body; it is less bushy than that of *M. toufæa* and *M. leucolachnæa*, but more so than in *M. foina*. The texture of the fur is woolly.

The type is in the British Museum collection (no. 98. 3. 18. 1), and was purchased by Mr. Abel Chapman in Andalusia, where it was killed in the Sierra de Jerez.

Mustela leucolachnæa, Blanford

(*op. cit.* 1879),

which has the throat-patch white, the colour of the fur sepia-brown, very slightly redder than in *M. foina*; the texture of the fur woolly, and the underfur very light in colour.

Mustela toufæa, Hodgson

(J. A. S. B. 1842, p. 281; Blyth, J. A. S. B. 1847, p. 353),

which has the throat-patch slightly yellowish; the texture of the fur closer than in *M. leucolachnæa*; the underfur of the same colour, reddish sepia-brown, as the longer hairs.

Key to the Species.

a'. Underfur lighter than the longer hairs.

b'. Fur light reddish sepia *M. mediterranea*.

b''. Fur dark sepia.

* The throat-patch in the specimens of *M. mediterranea* which I have been able to examine extends to the region between the fore legs, and in some cases reaches them. I do not, however, regard this character as of any importance, since the extent of the throat-patch in the martens, both of the present group and in the case of *M. martes*, seems to be very variable. It may or may not reach the legs, it may enclose islands of the darker fur, or may surround a peninsula of dark fur running anteriorly up the breast from the belly.

c'. Fur woolly	<i>M. leucolachnæa.</i>
c''. Fur not woolly	<i>M. foïna.</i>
a''. Fur of uniform colour throughout	<i>M. toufæa.</i>

There remains the supposed species *M. intermedia*, the name given by Severtzoff* to specimens which he described as being intermediate in character between *M. martes* and *M. foïna*. As, however, the only intermediate character specified was the colour of the throat, and the whole description of the supposed species is inadequate, I can only for the present treat this name as a synonym of *M. martes*. I imagine that the description was made through ignorance of the variability of the colour and size of the throat-patch in the martes.

LXVIII.—*Note on the Tunicate Fauna of Australian Seas.*

By W. A. HERDMAN, D.Sc., F.R.S., Professor of Natural History in University College, Liverpool.

FOR some years I have been engaged in studying a large collection of Australian Tunicata sent to me by the Trustees of the Australian Museum at Sydney, in order that I might prepare one of their museum catalogues. That work is now finished: I have returned the collection of type specimens to the Curator of the Australian Museum, and have deposited the MS. and drawings of the catalogue † in the hands of the Agent-General for New South Wales. As I understand it may be some time before the Trustees of the Museum are able to publish this catalogue, I think it will be useful if I make known to fellow-workers what species are described in my MS. I also add to the list other species which have been described from Australia but are not represented in the museum collection, so as to make this a complete record of the Tunicate fauna of Australian seas so far as is known to me.

LIST OF AUSTRALIAN TUNICATA.

In the following list the sixty-three species described and figured as new in the Catalogue of the Tunicata in the Australian Museum are denoted by an asterisk.

* Proc. Mosc. Soc. Nat. vol. viii. p. 2 (1873), translated by J. Carl Cræmers in Ann. & Mag. Nat. Hist. 1876, ser. 4, vol. xviii. pp. 45, 46.

† Over 300 pages of description and 45 octavo plates.

ASCIDIACEA.

ASCIDIÆ SIMPLICES.

Family 1. Molgulidæ.

- * *Ascopera nana*, Herdm. Port Jackson.
- * *Molgula mollis*, Herdm. Port Jackson.
- *Forbesi*, Herdm. Port Jackson.
- * — *sydneyensis*, Herdm. Sydney Harbour.
- * — *recumbens*, Herdm. Port Jackson.
- *inconspicua*, Stimp. Port Jackson.
- ? *Molgula (Cæsira) parasitica*, Macd. King George's Sound.
- ? — (—) *ficus*, Macd. Shark Bay.
- ? — (—) *pellucida*, Macd. Shark Bay.
- ? *Ctenicella (Ascidia) tumulus*, Quoy and Gaimard. Port Western.
- ? *Molgula (Ascidia) sabulosa*, Q. & G. Port Western.

Family 2. Cynthiidæ.

Subfamily BOLTENININÆ.

- Boltenia gibbosa*, Heller (?= *Ascidia spinifera*, Q. & G.). Bass Strait and Port Jackson.
- *australis* (Q. & G.). Port Jackson, Port Western, &c.
- *pachydermatina*, Herdm. Port Jackson &c.
- * — *tuberculata*, Herdm. Port Jackson and Port Stephen.

Subfamily CYNTHIINÆ.

- Microcosmus affinis*, Heller. Australia.
- *polymorphus*, Heller. Bass Str., 40 fath.
- *Helleri*, Herdm. Torres Straits and Amboina.
- *propinquus*, Herdm. Bass Str., 40 fath.
- *Julinii*, v. Dr. Sydney.
- *distans*, Heller. New South Wales.
- * — *Draschii*, Herdm. Port Jackson and Port Stephen.
- * — *australis*, Herdm. Port Jackson.
- * — *Ramsayi*, Herdm. Port Jackson.
- Rhabdocynthia* † *complanata*, Herdm. Port Jackson, 6 fath.
- *tenuis* (?), Herdm. Amboina.
- sp. (?), Sluit. Thursday Island.

† I know of three other new species of *Rhabdocynthia* from the north of Australia, but they are not yet described. They are in the collection brought home from Torres Straits by Professor A. C. Haddon.

- Cynthia præputialis*, Heller. Port Jackson.
 — *arenosa*, Herdm. Torres Str., 1–8 fath.
 — *formosa*, Herdm. Torres Str., 3–11 fath.
 — *cerebriiformis*, Herdm. Port Jackson, 30 fath.
 — *irregularis*, Herdm. Port Jackson, 2–10 fath.
 — *fissa*, Herdm. Bass Str., 40 fath.
 — *arcuata*, Heller. New South Wales.
 — *grandis*, Heller. Sydney.
 — *hispida*, Herdm. Bass Str., 40 fath.
 — *dumosa*, Stimp. Port Jackson.
 — *sabulosa*, Stimp. Port Jackson.
 — *lævissima*, Stimp. Port Jackson.
 * — *molguloides*, Herdm. Port Jackson.
 * — *solanum*, Herdm. Port Jackson.
 * — *multiradicata*, Herdm. Port Stephen.
 * — *cataphracta*, Herdm. Port Jackson.
 * — *spinifera*, Herdm. Port Jackson.
 * — *crinitistellata*, Herdm. Port Jackson.
 ? *Cynthia (Ascidia) aurora*, Q. & G. Port Western.
 ? — (—) *reticulata*, Q. & G. King George's Sound.
 ? — (—) *erythrostoma*, Q. & G. New Zealand.
 ? — (—) *ianthinostoma*, Q. & G. New Zealand.
 ? — (—) *cærulea*, Q. & G. New Zealand.
 ? — (—) *spinosa*, Q. & G. King George's Sound.

Subfamily *STYELINÆ*.

- Styela radicata*, Herdm. Bass Str., 40 fath.
 — *humilis*, Heller. New Zealand.
 — *captiosa*, Sluit. Amboina.
 — *palinorsa*, Sluit. Amboina.
 — *exigua*, Herdm. Port Jackson.
 — *plicata*, Les. (= *S. gyrosa*, Heller). Port Jackson &c.
 — *phaula*, Sluit. Thursday Island.
 — *solvens*, Sluit. Amboina.
 * — *pinguis*, Herdm. Port Jackson.
 * — *Etheridgii*, Herdm. Port Jackson.
 * — *Whiteleggii*, Herdm. Port Jackson, Port Stephen.
 * — *personata*, Herdm. Port Jackson.
 * — *stolonifera*, Herdm. Moreton Bay.
Polycarpa tinctor, Q. & G. Port Jackson, &c.
 — *aurata*, Q. & G. (= *P. sulcata*, Herdm., = *P. pneumonodes*, Sluit.). Port Jackson, &c.
 — *radicata*, Herdm. Port Jackson and Twofold Bay, 120 fath.
 — *viridis*, Herdm. Port Jackson and Port Stephen.
- Ann. & Mag. N. Hist. Ser. 7. Vol. i. 33

- Polycarpa pedunculata*, Heller. Bass Str.
 — *elata*, Heller. (?) Australia or New Zealand.
 — *longisiphonica*, Herdm. Port Jackson, &c.
 — *Stimpsoni*, Heller. Sydney.
 — *obscura*, Heller. Bass Str.
 — *nebulosa*, Heller. (?) Australia or New Zealand.
 — *pilella*, Herdm. Port Stephen.
 — *rigida*, Herdm. Bass Str., 40 fath., Port Jackson, &c.
 — *bassi*, Herdm. Bass Str.
 — *molguloides*, Herdm. Bass Str., 40 fath.
 * — *fungiformis*, Herdm. Moreton Bay.
 * — *stephenensis*, Herdm. Port Stephen.
 * — *Sluiteri*, Herdm. Port Jackson.
 * — *sacciformis*, Herdm. Port Jackson.
 * — *jacksoniana*, Herdm. Port Jackson.
 * — *attollens*, Herdm. Port Jackson.

Family 3. Ascidiidæ.

Subfamily CIONINÆ.

- Ciona* (?) *intestinalis*, Linn. Off Cockatoo Island, Port Jackson.
Rhodosoma (*Pera*) *Huxleyi*, Macd. Bellona Reefs.
 (? = *Peroides*, Macd. also.)

Subfamily ASCIDIINÆ.

- ? *Ascidia diaphana*, Q. & G. Hobart Town.
Ascidia cylindracea, Herdm. Twofold Bay, 120 fath.
 — *pyriformis*, Herdm. Port Jackson, 6 fath.
 — *succida*, Stimp. Port Jackson, low tide.
 — *sydneyensis*, Stimp. Port Jackson, low tide.
 — *bifissa*, Sluit. Amboina.
 — *empheres*, Sluit. Amboina.
 — *gemmata*, Sluit. Amboina.
 — *kreagra*, Sluit. Amboina.
 * — *incerta*, Herdm. Port Jackson, 6–8 fath.
 * — *phallusioides*, Herdm. Port Jackson, 6–8 fath.
Pachychlæna oblonga, Herdm. Bass Str., 40 fath.
 — *obesa*, Herdm. Bass Str., 40 fath.
Abyssascidia Wyvillii, Herdm. South of Australia, 2600 fath.

Family 4. Clavelinidæ.

- Perophora Hutchisoni*, Macd. King George's Sound.
 **Podoclavella meridionalis*, Herdm. Port Jackson, Amboina,
 Thursday Is.
 **Stereoclavella australis*, Herdm. Nacluse, Port Jackson,
 low tide.
 *—— sp.? Broughton Islands.
Ecteinascidia euphues, Sluit.
 —— *psammodes*, Sluit.
Rhopalopsis crassa, Herdm. Ki Is., 129 fath.
 —— *fusca*, Herdm. Banda, 17 fath.
 [? *Chondrostachys*, sp., Macd. Bass Str., 10–12 fath.]

ASCIDIÆ COMPOSITÆ.

I. MEROSOMATA †.

Family 1. Distomidæ.

- Colella pedunculata*, Q. & G. Port Western &c.
 —— *pulchra*, Herdm. Torres Str., 6 fath.
 —— *elongata*, Herdm. Port Jackson, 30 fath.
 —— *Murrayi*, Herdm. S.E. Australia, 120 fath., and
 Port Jackson.
 ——, var. *rubida*. Bass Str., 38 fath.
 *—— *plicata*, Herdm. (? = *C. cerebriformis*, Q. & G.). Port
 Jackson, &c.
 *—— *tenuicaulis*, Herdm. Port Jackson, Port Stephen.
 *—— *claviformis*, Herdm. Port Jackson.
 *—— *cyanea*, Herdm. Port Jackson.
Distoma deerrata, Sluit. Thursday Is., Torres Str.
 ? *Chondrostachys*, sp., Macd. Bass Str., 10–12 fath.
 ? *Polyclinum cylindricum*, Q. & G. Port Western.

Family 2. Polyclinidæ.

- Sigillina australis*, Sav. Port Jackson [Whitelegge].
Atopogaster aurantiaca, Herdm. Bass Str., 40 fath.
Polyclinum fungosum, Herdm. Port Jackson, 6–15 fath.
 —— *depressum*, Herdm. Torres Str., 3–11 fath.
 —— *glabrum*, Sluit. Amboina.

† Modified from Sluiter's classification, and including those families of Compound Ascidiæ which are related to the Clavelinidæ, and in which the body is divided into regions, such as the Distomidæ and the Polyclinidæ.

- Polyclinum hospitale*, Sluit. Thursday Island.
 *— *clava*, Herdm. Port Jackson.
 *— *giganteum*, Herdm. Port Jackson.
 *— *globosum*, Herdm. Port Jackson.
 *— *complanatum*, Herdm. Port Jackson.
 *— *fuscum*, Herdm. Port Jackson.
 *— *prunum*, Herdm. Port Jackson.
 *? *Polyclinum nigrum*, Herdm. Nacluse, Port Jackson.
Amaroucium albidum, Herdm. Bass Str., 40 fath.
 — *Ritteri*, Sluit. Thursday Is.
 *— *rotundatum*, Herdm. Port Jackson.
 *— *protectans*, Herdm. Port Jackson.
 *— *distomoides*, Herdm. Port Jackson.
 *— *anomalum*, Herdm. (? = *Polyclinoides*, sp., Macd.).
 Sydney Harbour.
Psammaphidium spongiforme, Herdm. Port Jackson, 7 fath.
 — *ovatum*, Herdm. Torres Str., 3-11 fath.
 — *pyriforme*, Herdm. N. Australia, 8 fath.
 *— *solidum*, Herdm. Port Jackson.
 *— *lobatum*, Herdm. Port Jackson.
 *— *fragile*, Herdm. Port Jackson.
 *— *incrustans*, Herdm. Port Stephen.
 *— *pedunculatum*, Herdm. ? Port Jackson.

Family 3. Didemnidæ.

- Didemnum aurantiacum*, Herdm. Bass Str., 38 fath.
Leptoclinum jacksoni, Herdm. Port Jackson, 6-15 fath.
 — *psammathodes*, Sluit. Thursday Is.
 — *pantherinum*, Sluit. Amboina.
 — *pustulosum*, Sluit. Amboina.
 — *torresii*, Sluit. Thursday Is.
 — *siphoniatum*, Sluit. Amboina.
 — *asteropum*, Sluit. Amboina.
 *— *incanum*, Herdm. Port Jackson.
 *— *fimbriatum*, Herdm. Port Jackson.
 *— *patulum*, Herdm. Port Jackson.

Family 4. Diplosomidæ.

- Diplosoma Rayneri*, Macd. Sydney Harbour (?).

II. HOLOSOMATA†.

Family 1. Polystyelidæ.

- Synstyela incrustans*, Herdm. Thursday Is.
 * *Goodsiria lapidosa*, Herdm. Port Jackson.
 * *Chorizocormus sydneyensis*, Herdm. Port Jackson.
 * — *subfuscus*, Herdm. Port Jackson.
 * — *leucophæus*, Herdm. Port Jackson.

Family 2. Botryllidæ.

- Botryllus* (? *Symplegma*) *racemosus*, Q. & G. New Zealand.
 ? *Botryllus* (*Distomus*) *violaceus*, Q. & G. Port Western.
 * *Botrylloides leptum*, Herdm. Port Jackson.
 * — —, var., Herdm. Port Jackson.
 * *Sarcobotrylloides jacksonianum*, Herdm. Port Jackson.
 * — *anceps*, Herdm. Port Jackson.
 * — *purpureum*, Herdm. Port Jackson and Port Stephen.
 * — *pannosum*, Herdm. Port Stephen.

ASCIDIÆ SALPIFORMES.

Family Pyrosomidæ.

- Pyrosoma*, sp. (?) [Whitelegge]. Bondi and Coogee.
 — *giganteum*, Lesueur. S. of Australia.

THALIA CEA.

Family 1. Doliolidæ.

- Doliolum denticulatum*, Q. & G. Off Port Jackson &c.
 — *Ehrenbergi*, Krohn. Between Sydney and New Zealand.

Family 2. Salpidæ.

- Salpa democratica-mucronata*, Forsk. Off Port Jackson &c.
 — *cylindrica*, Cuv. Amboina.
 — *scutigera-confœderata*, Cuv.-Forsk. Amboina.
 — *costata-tilesii*, Q. & G.-Cuv. Between Sydney and New Zealand.
 — *cordiformis-zonaria*, Q. & G.-Pallas. Between Sydney and New Zealand.

† Modified from Sluiter's classification, and including those families of Compound Ascidians which are related to the Cynthiidæ and in which the compact body is not divisible into regions, viz. the Polystyelidæ and the Botryllidæ.

L A R V A C E A.

Family Appendiculariida.

Appendicularia, sp. (?) [Whitelegge]. Port Jackson.

The above list comprises 180 species—a greater number than that (about 176) known from the shores of North-western Europe, a nearly corresponding area of coast in the Northern hemisphere, and the one which, of all the world, has been most exhaustively worked up. But even this large number of species does not complete the Australian Tunicate fauna, as I have seen from a preliminary examination of the large collections brought back from Australian seas by Professor A. C. Haddon and by Dr. A. Willey that they each contain some additional undescribed species. This great abundance of species in these southern seas agrees with the view I expressed in the 'Challenger' Report, that Ascidians "attain their greatest numerical development in southern temperate regions," and bears out especially the remark made long before by Quoy and Gaimard:—"La Nouvelle-Hollande, dans sa partie sud, et la Nouvelle-Zélande, sont les lieux de prédilection des Ascidies en général."

I may add that the extra-tropical southern species do not show any special relationship to the species of the northern hemisphere. I do not think that the Tunicata can be said to give any support to a "bipolar" hypothesis.

LXIX.—*Description of a new Genus of Cyprinoid Fishes from Siam.* By G. A. BOULENGER, F.R.S.

CATLOCARPIO.

Allied to *Catla*, C. & V., with which this genus agrees in the structure of the mouth, with large maxillary bone covering the slender protractile præmaxillary, the thin cephalic integument, the absence of barbels, the subinferior position of the eyes, the very long and fine gill-rakers, the large scales, and the short anal fin; differing in the short dorsal fin, with nine branched rays, and the disposition of the (4) pharyngeal teeth in a single series.

Catlocarpio siamensis.

Head large, flat above; eyes visible from below and not from above; mouth wide, terminal, maxillary extending to below anterior border of eye; lower lip much developed, but interrupted at the mandibular symphysis; nostrils large; eye $6\frac{1}{2}$ times in length of head, 3 times in interorbital width; a much developed thin dermal fold bordering the gill-cover. Gill-rakers a little longer than gill-fringes, 110 on anterior arch. Depth of body equal to length of head, $2\frac{3}{4}$ times in total length. Dorsal IV 9, originating above base of ventrals, at equal distance from the end of the snout and the base of the caudal; first branched ray longest, $\frac{3}{4}$ length of head. Pectoral a little shorter than ventral, a little more than $\frac{1}{2}$ length of head, reaching beyond base of ventral; latter fin reaching vent. Anal IV 5. Caudal deeply forked, middle rays not half as long as outer. Caudal peduncle as long as deep. Scales $39\frac{6}{13}$; 5 series of scales between lateral line and ventral; lateral line complete. Bronzy brown above, silvery beneath; fins blackish towards the end.

Total length 210 millim.

The British Museum has received from the Royal Siamese Museum, through its Curator, Mr. S. S. Flower, a single specimen of this highly interesting new fish. It was procured in the Menam River.

LXX.—On Seven new Small Mammals from Ecuador and Venezuela. By OLDFIELD THOMAS.

THE British Museum owes to the generosity of Mr. Ludovic Söderström, Her Majesty's Consul at Quito, a small collection of mammals from Ecuador, and, besides several species obtained by Mr. L. Fraser and described by Mr. Tomes, there are examples of the two new species described below. Mr. Söderström was also the discoverer of the *Ichthyomys Söderströmi* and *Pudua mephistopheles*, described by Mr. de Winton in 1896*. I have also taken the opportunity of describing some further new species recently received from Venezuela.

Reithrodontomys Söderströmi, sp. n.

Size fairly large, nearly equalling that of *R. costaricensis*, Allen. General colour dull greyish fawn, not nearly so rufous

* P. Z. S. 1896, p. 507.

as in *R. costaricensis*. Brighter lateral line little developed. Under surface not sharply defined, its colour much less bright than in *costaricensis*, the tips of the hairs more or less buffy or fawn-coloured. Ears thinly haired, brown, little darker than the general colour. Hands and feet white, without darker markings on the metapodials. Tail pale brown above and below, the tip white.

Skull low, with a flat superior profile. Palatal foramina short, barely reaching backward to the level of the front of *m*.¹.

Dimensions of the type (measured in skin):—

Head and body 72 millim.; tail (extreme tip doubtfully perfect) 83; hind foot (wet) without claws 19; ear (wet) 14.

Skull: back of parietal to nasal tip 21.1; greatest breadth 11.5; nasals 8.9 × 2.6; interorbital breadth 3.7; palate length from henselion 9.2; diastema 5.9; palatal foramina 4.1 × 1.6; length of upper molar series 3.8.

Hab. Quito.

Type: B. M. no. 98. 5. 1. 9. Killed August 1897.

"Feeds on flowers and seeds in the gardens. Comes out from among the climbing plants every evening at about 7 P.M." (*L. Söderström*).

This is by far the most southern record for the genus *Reithrodontomys*, which has not hitherto been found south of Costa Rica.

ÆPEOMYS *, gen. nov.

Type *Oryzomys* (?) *lugens*, Thos.†

Molars about as in *Oryzomys*. Skull in general shape, and especially in that of the anterior zygoma-root, as in the less specialized species of *Oxymycterus*. Thumb with a nail; claws not specially lengthened.

From what was said in the original description of "*O. lugens*" it will be understood with what doubt that species was placed in *Oryzomys*, and the discovery by Mr. Söderström of a second species closely allied to it renders it advisable that a genus should be formed for its reception.

Æpeomys vulcani, sp. n.

Fur excessively long, soft, and woolly, the underfur about 12 and the longer hairs 15 millim. in length. General colour uniform dark buffy grey, not far from the "clove-brown" of Ridgway; this colour is slightly darker along the top of the

* *altos*, a height.

† Ann. & Mag. Nat. Hist. (6) xviii. p. 306 (1896).

loins, but there is little difference over the rest of the upper surface. Projecting tips of longer hairs whitish. Belly not sharply defined, the hairs slate-coloured except at their extreme tips, which are buffy. Ears scarcely projecting from the long fur of the head, the anterior third of their outer surfaces black. Metapodials brown mesially, whitish laterally, as are also the digits. Tail shorter than in *Æ. lugens*, barely as long as the head without the body, finely scaled, short-haired, brown throughout.

The skull of the type is unfortunately very imperfect, but it differs from that of *Æ. lugens* by its shorter nasals and rather broader anterior zygoma-root. The slanting shape of the latter is quite as in the type species.

Dimensions of the type (measured in skin) :—

Head and body 111 millim.; tail 84; hind foot without claws 25; ear (approximately) 13.

Skull: length of nasals 10·1; interorbital breadth 6; diastema 7·5; palatal foramina 5·5 × 2·1. Lower jaw: condyle to incisor-tips 18·1; length of lower molar series 5·7.

Hab. Mount Pichincha, Ecuador, at about 12,000 feet.

Type: B. M. no. 98. 5. 1. 10. Killed May 1897.

Æ. vulcani may be distinguished from its ally *Æ. lugens* by its longer softer fur and much shorter tail.

Thomasomys paramorum, sp. n.

Considerably smaller than *T. cinereus*. Fur long, soft, and woolly, the hairs on the back about 15 millim. in length. General colour, so far as can be made out in a spirit-specimen, dark rufous brown; belly dull whitish, not sharply defined. Ears large, evenly rounded, without anterior basal projection, well-haired, dark brown. Hands and feet white above, without darker metapodials. Tail long, well-haired, the hairs almost hiding the scales, but not specially pencilled at its tip; brown above, rather lighter below, but not markedly bicolor. Mammæ 1—2=6.

Skull slender and very delicately built, the bones of the brain-case exceedingly thin and papery. Muzzle narrow. Interorbital region parallel-sided, narrow, its edges rounded, without ridges, though it is flattened mesially. Brain-case long, narrow, smoothly rounded. Front edge of zygoma-root nearly vertical, without projection. Palatal foramina long, reaching backward to the level of the front lamina of *m.*¹. Bullæ larger than in *T. cinereus*. Incisors narrow, dark orange in front. Molar structure much as in *T. cinereus*, *m.*¹ distinctly 6-cusped, not 5-cusped as in *Peromyscus*.

Dimensions of the type (a female, measured in spirit) :—

Head and body 96 millim.; tail 130; hind foot without claws 24·5; ear 18.

Skull: basal length 23·5; basilar length from henselion 22; greatest breadth 13·8; nasals, length 10; interorbital breadth 4·5; brain-case, length * 14·7, breadth 12·7; diastema 6·7; palatal foramina 5·6; length of upper molar series 4·2.

Hab. Paramo, south of Chimborazo.

Type: B. M. no. 97. 11. 7. 82. Collected by Mr. W. F. H. Rosenberg.

The external proportions and the narrowness and extreme delicacy of the skull will readily separate *T. paramorum* from any of its allies.

Oryzomys vestitus, sp. n.

Very similar in proportions and general colour above to *O. meridensis*, but the fur very much longer, softer, and woollier. Hairs of the back 14 or 15 millim. in length. General colour grizzled fuscous grey, becoming more rufous posteriorly. Head clearer grey. Ears of medium size, very thinly haired, the few short hairs pale brown. Under surface of body uniformly dirty greyish, the hairs washed with dull buffy terminally; no white on chest or throat; line of demarcation on sides quite indistinct. Hands and feet dull whitish above. Tail comparatively well-haired, pale brown above and below.

Skull broad and peculiarly depressed in the cranial region, the height of the brain-case being no greater than in an old specimen of *O. meridensis*, while its breadth is very markedly greater. Nasals short and narrow. Interorbital region flattened above, its edges rounded or faintly squared, but not ridged. Anterior edge of zygoma-root quite vertical, without forward projection. Palatine foramina of medium length, but narrow, and unusually far apart, the septum between them 1·5 millim. wide posteriorly; they end in front of *m*.¹ a distance equal to the length of *m*.³. Incisors broad and strong, orange above, yellow below. Molars of normal *Oryzomys* structure.

Dimensions of the type (an adult male, measured in skin) :—

Head and body 138 millim.; tail 166; hind foot 33·3; ear 17.

* The length of the brain-case may be conveniently taken in all Murines from the hinder border of the interparietal to the centre of the line dividing the olfactory chamber from the rest of the brain-case. Internally there is a transverse ridge at this point, which readily shows through on the upper surface.

Skull: extreme length 36·2; basilar length 29·2; greatest breadth 19·3; nasals $12·7 \times 4·1$; interorbital breadth 4·9; brain-case, length 16·5, breadth just behind zygoma-root 16; interparietal $5 \times 10·6$; palate length from henselion 15·8; diastema 10·2; palatal foramina $6·6 \times 3$; length of upper molar series 6·2.

Hab. Rio Milla, Merida, 1630 m. Coll. S. Briceno.

Type: B. M. no. 98. 5. 15. 3. Killed March 7, 1897.

This very peculiar species has a superficial resemblance to *O. meridensis*, but may be readily distinguished externally by its soft fur and dull-coloured belly. Its broad flat skull is different from that of any species known to me, and even recalls that of the South-African *Graphiurus platyops*.

Marmosa marica, sp. n.

Most nearly allied to *M. pusilla*, Desm., but decidedly larger. Fur rather long for this group, the hairs of the back about 10 millim. in length. General colour greyish fawn, not uniform, but decidedly wavy, the darker tips to the hairs so disposed as to give a mottled or wavy appearance to the back. Centre of face paler fawn. Area round eyes black. Cheeks, chin, and throat yellowish or creamy white, the hairs light to their roots; belly similar, but less strongly yellowish, and the hairs slaty basally; line of demarcation on sides not strongly marked. Upper surface of hands and feet dull whitish. Tail very short-haired, paler brown above, rather whiter below.

Skull much larger than in the typical *M. pusilla*. Muzzle broad. Zygomata evenly and boldly expanded. Interorbital space flat, parallel-sided, its edges just thickened into indistinct parallel ridges, not forming postorbital processes. Palate broad. Canines small. Last upper premolar slightly smaller than the middle one.

Dimensions of the type (an adult male, in skin):—

Head and body 102 millim.; tail 131; hind foot (wet) 16·5; ear 16.

Skull: basal length 25; greatest breadth 15·6; nasals $12 \times 3·6$; interorbital breadth 4·8; palate, length 15, breadth between outer corners of *m.*³ 8·5; combined length of *ms.*¹⁻³ 4·7.

Hab. Rio Abbarregas, Merida, Venezuela, alt. 1630 m. Coll. S. Briceno.

Type: B. M. no. 98. 5. 15. 1. Killed Jan. 24, 1897.

This is the species which, with some doubt, I referred to *M. pusilla* in 1896, but the recent presentation to the Museum of a Paraguayan specimen of that species, practically a topo-

type, by Mr. J. Graham Kerr, enables me to make a better comparison between the two than was formerly possible. The true *pusilla* is much smaller, has a narrower and more rounded skull, while its dorsal colour does not show the peculiar waviness which additional material proves to be quite constant in the Merida form. The same is true of Lagoa Santa specimens representing Burmeister's *Grymæomys agilis*.

Marmosa dryas, sp. n.

Size of *M. marica*. Fur long, as in that species. General colour dull rufous fawn, darker and more uniform than in that species. Centre of face but little lighter. Under surface dull rufous throughout, except for a white patch on the chest; no line of demarcation on sides. Cheeks and chin rather paler rufous, not white. Hands and feet whitish above, Tail very short-haired as usual, brown above, rather paler below.

Skull with a much narrower and more sharply pointed muzzle than in *M. marica*. Zygomata not so boldly divergent as in that animal, especially anteriorly, where, in fact, their profile, as viewed from above, is almost concave. Inter-orbital region smooth, its edges diverging backwards, not ridged. Palate longer and narrower than in the allied species, the two rows of teeth more nearly parallel.

Dimensions of the type (an adult skin, said to be that of a male):—

Head and body 97 millim.; tail 147; hind foot (wet) 18·4; ear 16.

Skull: basal length 24·8; greatest breadth 15; nasals 11·7 × 3·3; interorbital breadth 5·2; palate, length 15, breadth between outer corners of *m.*³ 8·1; combined length of *ms.*¹⁻³ 4·9.

Hab. Culata, Merida, 4000 m. Coll. S. Briceno.

Type: B. M. no. 98. 5. 15. 2. Killed Dec. 14, 1896.

Some time ago Mr. Briceno sent home a single specimen of this form, but I could not then be sure that it was not a mere spasmodic colour-variation of *M. marica*, but now four additional examples identical with the first have been obtained, and show conclusively that it is really a different species to the common Merida form. It may be readily distinguished by its darker general colour, its dull rufous instead of yellowish-white belly, and its narrower and more pointed skull.

Blarina meridensis, sp. n.

Size comparatively large, skull-length greater than in any member of the subgenus *Cryptotis* except *B. magna*, Merr. Colour darker, more sooty and less brown than in *B. Thomasi*, Merr., the only other South-American species. Tail much longer than in that species. Internal cusps to unicuspid indistinct, not definitely at the postero-internal angle of the tooth as in *B. Thomasi*. Back of large upper premolar not deeply excavated.

Dimensions of the type (measured in skin):—

Head and body 79 millim.; tail 37; hind foot, without claws 14, with claws 15·3.

Skull: greatest length, including incisors, 23·7; greatest breadth 11; tip of incisors to chief cusp of p^4 5·2.

Hab. Merida, alt. 2165 m. Coll. S. Briceno.

Type: B. M. no. 98. 5. 15. 5.

Dr. Merriam has shown that the members of this genus, like as they are in colour and general appearance, can be readily divided into species by their size, proportions, and the shapes of their premolars. In these respects none of the species in Dr. Merriam's monograph at all agree with *B. meridensis*. Its only geographical ally, *B. Thomasi*, from Bogota, is readily distinguishable by its smaller size and shorter tail.

LXXI.—*Scorpions, Pedipalpi, and Spiders from the Solomon Islands.* By R. I. Pocock, of the British Museum of Natural History.

[Plate XIX.]

PART of the material contained in the British Museum upon which this small contribution to the arachnology of the Solomon Islands is based was purchased from Mr. C. M. Woodford in 1887. A second instalment was procured by the officers of H.M.S. 'Penguin' (Commander A. J. Balfour commanding), and was presented to the Trustees in 1894 and 1895 by the Lords of the Admiralty.

In Thorell's tables of distribution of spiders occurring in the Austro-Malayan area (published in 1881 in vol. xvii. of the Ann. Mus. Genova) only one species of the order is recorded from the Solomon Islands. This is *Argiope bougainvilla* of Walckenaer. Walckenaer, however, mentions two more species, namely *Ctenus marginatus* and *Nephila vitiensis*, as doubtfully coming from this locality, and in the

last volume of 'Die Arachniden Australiens' Keyserling records three more. Consequently it will not, I think, be far wide of the truth to say that up to the present time only about half a dozen species of spiders have been recorded from this interesting archipelago. The material I have been able to examine has added considerably to the list, the number of known species now amounting to twenty-nine.

Concerning the affinities of the fauna, it need only be said that it closely resembles, so far as genera and also so far as species are concerned, that of Papua and the neighbouring islands of the Austro-Malayan seas.

The species marked with an asterisk are unknown to me.

Order SCORPIONES.

Genus HORMURUS, Thorell.

1. *Hormurus australasie* (Fabr.).

Hormurus australasie (Fabr.), Syst. Ent. p. 399 (1775); and all recent authors.

Loc. New Georgia (*H.M.S. 'Penguin'*), and probably Shortland Island (*C. M. Woodford*).

2. *Hormurus Karschii*, Keyserling.

Hormurus Karschii, Keyserling, Die Arachniden Australiens, 1885, p. 31.

Loc. New Georgia (*H.M.S. 'Penguin'*). The British Museum has also received from Mr. Simpson specimens of this species from the Solomon Islands. It is common in New Guinea.

Order PEDIPALPI.

Genus CHARON, Karsch.

1. *Charon Grayi*, Gervais.

Charon Grayi, Gervais, Ins. Apt. iii. p. 4 (1842).

Loc. New Georgia (*H.M.S. 'Penguin'*).

Previously recorded by Prof. Kraepelin from the Solomon Islands. A comparison between the specimens procured in New Georgia and the typical example from the Philippines leads me to think the synonymy of the species given by Prof. Kraepelin is probably correct (see Abh. naturwiss. Ver. Hamburg, xiii. p. 42, 1895).

Order ARANEÆ.

Family Ctenizidæ.

Genus CONOTHELE, Thorell.

1. *Conothele nigriceps*, sp. n. (Pl. XIX. fig. 1.)

♂.—*Colour*. Carapace and mandibles black; anterior legs and palpi blackish brown, with the tarsi yellow; tibia of palp, distal end of protarsus of first leg and protarsus of second yellow; third leg rather paler than the second, fourth paler than the third; sternum and coxæ quite pale yellow; lower side of abdomen pale grey, dorsal side dark ashy grey.

Carapace subcircular, rugose throughout, swollen and elevated between the fovea and ocular tubercle, area just behind the tubercle depressed; tubercle large, wider than long; anterior median eyes the largest, close together, anterior laterals close to the edge of the clypeus, anterior line procurved, posterior line almost straight; carapace longer than patella, tibia, and tarsus of palp, slightly longer than patella and tibia of fourth leg, equal to those of first, and just about equal to tibia, protarsus, and tarsus of third leg.

Mandible with fang-groove armed below with five inner teeth and ten outer; *labium* with a row of four spinules and a few more behind; *maxillæ* sparsely spinulose basally and below.

Palp slender, scarcely projecting beyond the tip of the patella of the first leg; tibia longer than patella, slightly narrowed distally, four times as long as wide, furnished with long hairs below; tarsus short, oval, a little longer than wide, bulb elliptical, spine slender, slightly curved, thicker at the base, filiform at the tip.

Legs slender, 4, 1, 2, 3; femur of first armed internally with an irregular series of short spines; patella also with an internal series and several spines below; tibia thickly spined below, especially externally; protarsus with a double external row and a single internal row beneath; tarsus spiny externally: tibia, protarsus, and tarsus of second leg spiny externally, patella with one external spine, tibia and protarsus with one internal spine, tarsus with one or two internal spines: patella of third leg spiny anteriorly, tibia spiny along its distal margin above; protarsus with about three superior distal spines and many setiform spines below, tibia with a few inferior setiform spines, tarsus with some spinules in front and behind: tibia of fourth leg with a few spinules in front and below, protarsus and tarsus with many spinules

below; tarsi of first and second legs scopulate: claws armed with one longer and one shorter tooth.

Measurements in millimetres.—Total length 10; length of carapace 5·8, width 5·5; length of palpus 8, of first leg 15, of second 13, of third 11, of fourth 16 †; patella and tibia of first leg 6, of fourth 5.

Loc. Probably Shortland Island. A single example collected by Mr. C. M. Woodford.

All the previously described species of this genus, which ranges westward from the Solomon Islands as far as Burma, are based upon female examples, with which males cannot be profitably compared.

Family Argiopidæ.

Genus NEPHILA, Leach.

2. *Nephila maculata* (Fabr.).

Nephila maculata (Fabricius), Ent. Syst. ii. p. 425 (1793); and all recent authors.

Specimens of the typical form from New Georgia (*H.M.S. 'Penguin'*).

3. *Nephila maculata, Walckenaerii* (Dol.).

Epeira Walckenaerii (Dol.), Nat. Tijdschr. Nederland. Indië, xiii. p. 412 (1857); id. Acta Soc. Sci. Indo-Néerland. 1859, pl. i. fig. 4 (1859).

Nephila fuscipes, L. Koch, Die Arachn. Austral. i. p. 156, pl. xiii. fig. 1 (1871); Thorell, Ann. Mus. Genova, xvii. p. 146 (1881).

A single example of this subspecies procured by Mr. Woodford.

4. *Nephila imperialis* (Dol.).

Nephila imperialis (Dol.), Nat. Tijdschr. Nederland. Indië, xiii. p. 413 (1857); id. Acta Soc. Sci. Indo-Néerland. p. 28, pl. xii. fig. 2 (1859).

Loc. New Georgia (*H.M.S. 'Penguin'*). Specimen also procured by Mr. C. M. Woodford.

5. **Nephila vitiana* (Walck.).

Nephila vitiana (Walck.), Ins. Apt. iv. p. 471 (1847).

Recorded from the Solomon and Fiji Islands.

† In this and in all cases in this paper the legs are measured from the base of the femur, the coxa and trochanter being omitted.

Genus ARGIOPE, Aud. & Sav.

6. *Argiope picta*, L. Koch.

Argiope picta, L. Koch, Die Arachn. Austral. i. p. 33, pl. iii. fig. 3 (1871).

Argiope principalis, id. ibid. p. 207, pl. xviii. fig. 5.

A couple of examples collected by Mr. C. M. Woodford, probably in Shortland Island, belong to the form Dr. L. Koch described as *A. principalis*, a form which has been recorded from New Guinea, Fiji, Queensland, &c.

7. *Argiope leopardina*, sp. n. (Pl. XIX. figs. 2, 2 a.)

Colour. Carapace deep brown, with a yellowish border; palpi ferruginous, with black tarsi; legs uniformly blackish brown, not banded; coxæ blackish, sternum entirely clear yellow, maxillæ black, with yellow border; abdomen blackish brown above, spotted with yellow and marked in its anterior half with a large yellow patch, as broad as the abdomen in front, but narrowing posteriorly, and partially, or in some cases entirely, divided into two—a larger broad trapezoidal anterior patch and a smaller irregularly circular patch; the yellow spots smaller and larger, the larger ones traceable with more or less distinctness by their arrangement in transverse rows; sides of abdomen reddish above, black below; lower surface with the epigastric region black, with a broad median black band, interrupted in front by four or six white spots, extending along the middle line to the spinners; at its posterior end the band is defined on each side and narrowly behind by a triangular patch of an orange-yellow hue, which in front is in contact with the posterior end of a broad white stripe, three times or only twice as long as wide, with its posterior end produced into an external anguliform process; the stripe does not reach the epigastric fold in front, but ends internally in a short point just in front of the anterior white spot, while externally it is continued as a narrow white line forwards into a point on a level with a continuation of the epigastric fold.

Carapace a little shorter than tibia of fourth pair.

Abdomen oval, without shoulder-spikes.

Vulva as in *A. picta*.

Measurements in millimetres.—Total length 25; length of carapace 8·2, width 7·8; length of abdomen 17·5, width 11; length of first leg 46, of fourth 43·5.

Loc. Probably Shortland Island. Collected by C. M. Woodford.

This form apparently differs from *A. picta* and all its subspecies, i. e. *gorgonea*, *principalis*, and *faorensis* (see Thorell,

Ann. Mus. Genova, xvii. pp. 64-65), at least in the pattern of the lower side of the abdomen. So far as the upperside is concerned, *leopardina* perhaps comes nearest to *fuorensis*, a form which is unknown to me.

8. **Argiope bougainville* (Walck.).

Argiope bougainville (Walck.), Ins. Apt. iv. p. 473 (1847).

Recorded by Walckenaer from Bougainville Island.

Perhaps allied to *A. pentagona*, L. Koch.

Genus CYRTOPHORA, Simon.

9. *Cyrtophora cylindroides* (Walck.).

Epeira cylindroides, Walck. Ins. Apt. ii. p. 136 (1837) (*teste* Simon).

Epeira viridipes, Doleschall, Act. Soc. Sci. Indo-Néerland. 1859, p. 29, pl. i. fig. 7.

Epeira nephilina, L. Koch, Die Arachniden Austral. i. p. 90, pl. vii. fig. 6 (1871).

Recorded from Cochin China, Amboina, Yule Island, Queensland, &c. A single specimen was obtained by Mr. C. M. Woodford in 1887, probably from Shortland Island; and specimens have also been received from New Georgia (*H.M.S. 'Penguin'*).

10. *Cyrtophora unicolor* (Dol.).

Cyrtophora unicolor (Dol.), Nat. Tijdschr. Nederland. Indië, xiii. p. 419 (1857); id. Act. Soc. Sci. Indo-Néerland. v. pl. ii. fig. 1 (1859).

A single immature female referable to this or to a closely allied species was obtained by Mr. C. M. Woodford, probably in Shortland Island.

Genus ARANEUS, Linn.

11. *Araneus nauticus*, L. Koch.

Araneus nauticus, L. Koch, Ægyptische und Abyssinische Arachniden, p. 17, pl. ii. fig. 2 (1875).

Loc. Probably Shortland Island (*C. M. Woodford*).

12. *Araneus relacinus*, Keyserling.

Nephila relicina, Keyserling, Die Arachniden Australiens, p. 217, pl. xix. fig. 6 (1887).

Colour. Carapace, mandibles, sternum, coxæ, and mouth-parts bright red; femora of legs the same red tint except the tips of the first and second, which are steel-blue-black; patella, tibia, protarsi, and tarsi of first and second legs steel-blue-black; third leg the same colour as the second, except that the tibia has the base paler; fourth leg red, with the patella, tarsus, apex of tibia, and both ends of protarsus steel-blue-

black; palpi red, with tarsus apically infusate; abdomen with a broad silvery-white anteriorly and posteriorly narrowed dorsal median longitudinal band, bordered with black; sides of abdomen yellow, silvery in front, ochre-brown behind, and marked with a silvery-white stripe; lower surface bounded on each side with a silvery-white stripe; the middle field testaceous brown in front, smoky black in the middle; area all round the spinners yellow, spinners black.

Carapace as long as tibia of fourth leg, longer than patella and tibia of third; impressed on each side behind the head, which is convex from side to side and from before backwards; ocular quadrangle a little wider in front than behind, situated on a low eminence; the eyes subequal in size; eyes of anterior line slightly procurved; lateral eyes on a low eminence, without superciliary tubercle.

Legs long and slender, first nearly five times as long as carapace.

Abdomen nearly twice as long as broad, as high as wide, rounded in front, gradually narrowed behind; its posterior extremity convexly rounded, and produced beyond and above the spinners into a broad rounded prominence.

Vulva. Scape piriform, short and small as compared with the subjacent sclerite, its apex not projecting beyond the posterior border of the latter.

Measurements in millimetres.—Total length 18; length of carapace 5.5, width 4.8; length of abdomen 12, width 6.5; length of first leg 27, of second 25, of third 15, of fourth 25.

Loc. Probably Shortland Island, a single adult female collected by Mr. C. M. Woodford.

13. *Araneus Woodfordi*, sp. n. (Pl. XIX. figs. 3, 3 a.)

In shape and very largely in colour nearly allied to *A. relicinus*, but differing in that the upperside of the abdomen is occupied by a long, broad, black stripe, broad in front and behind, narrower in the middle, divided in front by a narrow, median, silvery-white stripe, and bordered on each side by a sharply defined silvery white stripe emphasized externally by a narrow black border line: the femora of the legs are in one specimen coloured as in *relicinus*, in another there is much more black; in both examples the fourth leg from patella to tarsus is of a uniform black.

Scape of *vulva* large and long, projecting some distance beyond the posterior edge of the inferior portion.

Measurements in millimetres.—Total length 15; length of carapace 5, of abdomen 10, of first leg 22, of fourth 22. (In the second specimen the legs are relatively longer.)

Loc. Probably Shortland Island (*C. M. Woodford*).

Though presenting a strong superficial resemblance, so far as regards the shape of the thorax and abdomen, to the species of the genus *Nephila*, the structure of the vulva in these species excludes them from the Nephilinae, and points to close relationship with the genus *Araneus* (*Epeira*).

Genus ARGYROEPEIRA, Emerton.

14. *Argyroepeira grata*, Guérin.

This widely distributed Austro-Malayan species has been recorded from the Solomon Islands by Keyserling as *Metacoccinea*, Doleschall (see 'Die Arachniden Australiens,' p. 208, 1887).

Genus PASILOBUS, Simon.

Pasilobus, Simon, Hist. Nat. Araignées, i. 1894, p. 881.

15. *Pasilobus mammatus*, sp. n. (Pl. XIX. fig. 4.)

Colour a nearly uniform blackish brown, abdominal tubercles paler; legs indistinctly annulate.

Carapace smooth above, irregularly granular at the sides, compressed on each side behind the head; width of head just about equal to length of tibia of first leg. *Abdomen* twice as wide as its median length; its anterior border mesially emarginate, the emargination furnished with six large tubercles, the edge outside the emargination directed obliquely outwards and backwards, and ending in a long tubercle directed forwards and outwards, near the base of which, but higher up and towards the middle line, are a pair of large tubercles; lateral margins short and parallel, tubercular; posterior margin widely convex, with four large tubercles in a transverse line in the middle; a pair of large tubercles in the centre of the dorsum; in addition to the tubercles mentioned, there are others of a smaller size scattered subsymmetrically on the dorsal surface.

Measurements in millimetres.—Total length 9; median length of abdomen 5.5, width of latter 11.

Loc. Probably Shortland Island (*C. M. Woodford*).

Differs from *P. bufoninus*, Sim., from the Moluccas, and from the Javan species *P. lunatus*, Sim., and *P. conohumeralis*, van Hasselt, in the tuberculation of the margins of the abdomen.

Genus ACTINACANTHA, Simon.

16. *Actinacantha scintillans*, Butler.

Actinacantha scintillans, Butler, Tr. Ent. Soc. 1873, pt. ii. p. 156, pl. iv. fig. 9.

A single example obtained by Mr. Woodford.

The locality of this species has been unknown up to the present time.

17. *Actinacantha metallica*, sp. n. (Pl. XIX. fig. 5.)

Colour. Carapace, mandibles, maxillæ, labium, and sternum black; legs of first, second, and third pairs, and palpi red or yellow, with black coxæ and infusate tarsi and protarsi; legs of fourth pair black; upperside of abdomen pale yellow, with black sigilla; the basal prominences of the spines and the lower surface shining metallic blue or green; lower side not spotted; spines of the same metallic hue.

Form of abdomen and disposition of spines as in *A. pentagona*, Walck., but the spines longer, the length of the median spine exceeding the width of the head, and the posterior spine is about equal to the width of the head.

Measurements in millimetres.—Total length (excluding mandibles and posterior spines) 10; length of abdomen along middle line 7·2, including posterior spine 10, width behind base of anterior spine 9·3, from tip to tip of median spines 16; width of head 3·2; approximate length of median spine 4.

Loc. Probably Shortland Island (C. M. Woodford).

Resembling *A. scintillans* and *A. regalis*, Butler, the latter from the New Hebrides, in shape of body, disposition and approximately in length of spines, as also in the metallic tint and absence of spots from the lower side of the abdomen; but in the former two species the anterior three pairs of legs and the palpi are entirely black, not red as in *metallica*.

Genus GASTERACANTHA, Sund.

18. *Gasteracantha signifer*, sp. n. (Pl. XIX. fig. 6.)

Colour. Carapace, sternum, maxillæ, legs, palpi, and mandibles entirely black, polished; abdomen a rich yellow above, the sigilla black, a large black central patch usually involving the ten central sigilla, but sometimes not extending forwards to the anterior six sigilla; the lower surface black in the middle below and behind nearly up to the posterior spines, sometimes without spots, sometimes with two behind the mamillæ, and sometimes with a second pair at the sides of the tubercle; sides of the lower surface yellow, with a yellow stripe running inwards over the black towards the middle line.

Abdomen variable in shape, its length along the middle

line a little greater or less than or about equal to half the width between the spines, the difference depending upon the greater or less development of the lateral wings which support the lateral spines; the anterior border on level with the eight anterior sigilla widely convex, truncate mesially, posterior border immediately behind the posterior line of nine sigilla straight or slightly convex, with the convexity looking backwards; lateral wings nearly parallel-sided, the spines sometimes nearly following the direction of their respective borders, but always diverging, sometimes a little, sometimes considerably, the anterior looking forwards and outwards, the posterior backwards and outwards, the border between them less than the length of the posterior spine, and almost always greater than that of the anterior, straight or directed inwards and backwards; posterior lateral spine twice or more than twice the length of the anterior lateral; posterior spines longer or about as long as anterior lateral, separated at the base by a space equalling from two to three times their own length and equal to or a little less than the length of the posterior lateral spine.

Measurements in millimetres (of two specimens, A and B).—Total length of abdomen along middle line in A 7, in B 5; between lateral spines in A 12.5, in B 12; from tip to tip of lateral spines in A 16.5, in B 18.

Loc. New Georgia (*H.M.S. 'Penguin'*: type). Specimens also procured by Mr. Woodford, probably in Shortland Island.

The structural variations in this species do not appear to be attributable to age nor to be correlated with geographical distribution, each one of the series of seven collected by Mr. Woodford being different from the rest; the same is true of the three collected in New Georgia.

There is little doubt that this species is identical with *G. mollusca* of Keyserling ('Die Arachniden Australiens,' 1886, p. 88, pl. vii. fig. 1); but it is to my mind quite distinct from the *G. mollusca* described and figured on p. 7, pl. i. fig. 4, of the same work sixteen years earlier. Keyserling, I think, confounded two species together when he described what is here named *G. signifer* as the adult of *G. mollusca*. At all events, none of the specimens of *signifer*, whether young or old, that I have seen agree with the figure and description of the original *G. mollusca*; and in Keyserling's collection of spiders, one of the specimens labelled by him *G. mollusca* is a representative of a form very like *G. signifer*, while the others are referable to a species closely allied to *G. Westringii*, Keyserling.

19. **Gasteracantha mollusca*, L. Koch.

Gasteracantha mollusca, L. Koch, Die Arachniden Australiens, i. p. 7, pl. i. fig. 4 (1871).

This species has been recorded by Keyserling from the Solomon Islands, but it does not appear from the reference whether the record applies to the genuine *G. mollusca* or to the form I have described as *G. signifer*; probably to the latter.

Family Pisauridæ.

Genus DOLOPÆUS, Thorell.

20. **Dolopæus (Thalassius) marginatus* (Walck.).

Ctenus marginatus, Walkenaer, Ins. Apt. iv. p. 402 (1847).

Recorded from the Solomon or Fiji Islands.

Genus DOLOMEDES, Latr.

21. *Dolomedes icadius*, L. Koch.

Dolomedes icadius, L. Koch, Die Arachniden Austral. ii. p. 859, pl. lxxiii. fig. 5.

A single adult female from New Georgia (*H.M.S. 'Penguin'*) agrees very closely with the description and figures of *D. icadius* recorded by Koch from several localities in Queensland.

22. *Dolomedes laticeps*, sp. n. (Pl. XIX. fig. 7.)

♂.—*Colour*. Carapace and legs mahogany-brown, carapace with wide lateral border of white hairs, the band extending from the edge over about one fourth of the upper surface, upper surface covered with whitish-brown hairs; a narrow white stripe in the middle line between the eyes; legs covered with a clothing of whitish hairs intermixed with longer bristles; abdomen whitish, darker above, with two blackish sinuous bands, defined by an external white line, in the anterior half of the upper surface and a sinuous darker stripe on each side behind.

Carapace nearly circular, only a little longer than wide, in length exceeding that of patella, tibia, and tarsus of palp, about equal to that of third tibia; *eyes* practically of relatively the same size and disposition as in *D. icadius*, the clypeus nearly twice the diameter of the anterior medians. Fang-groove of mandible armed with three teeth behind.

Palp short, reaching about as far as apex of first femur, its

tibia longer than its patella, about twice as long as broad, but shorter than the tarsus, armed at its distal end externally with a stout process; palpal organ as in figure (Pl. XIX. fig. 7).

Legs long and slender, 1 and 4, 2, 3, strongly spined; tibia of first and second with spines above.

Measurements in millimetres.—Total length 11·5; length of carapace 5, width 4·2; length of palp 6, of first leg 22, of second 21, of third 18, of fourth 22.

Loc. New Georgia (*H.M.S.* 'Penguin').

Apparently resembling *D. flaminus* and *D. facetus* of L. Koch in many structural features, but certainly differing from both in the form of its palpus. The greater width of the carapace as compared with its length forbids the view that the species is the male of the one I have identified as *D. icadius*, unless such a sexual difference is found to obtain in other species of the genus. In the female referred to *icadius* the length of the carapace is 7 and the width 5·5.

Family Heteropodidæ.

Genus PALYSTES, L. Koch.

23. *Palystes speciosus*, sp. n. (Pl. XIX. figs. 8, 8 a.)

♀.—*Colour*. Carapace clothed with yellowish-brown hairs, its integument reddish brown, blackish on the head-region; mandibles black, scantily clothed with greyish hairs, not striped; palpi and legs ochre-brown above; lower side of femora a rich brownish red; a fringe of fiery red or yellow hairs extending along the anterior and posterior sides of the protarsi above the greyish-black scopula, the fringe extending nearly halfway along the tibia of the first and second legs and also for a short distance on that of the third; coxæ ochre-brown, sternum deep brown, labium blackish, maxillæ same colour as sternum; abdomen parti-coloured, yellowish red above, with a median blackish longitudinal stripe narrowed posteriorly, laterally digitate, and joined in front with a transverse black band, which extends backwards on each side of the abdomen and expands into a broad, black, marginally badly-defined stripe reaching to the spinners; lower side of abdomen with a broad black stripe extending from the epigastric fold to the spinners and divided mesially by a fine red line, the area between the stripe and the lateral black area covered with hairs of a fiery red; epigastric area testaceous, bordered posteriorly with a red fringe; the area

on the upperside of the abdomen immediately behind the pedicle covered with yellowish-white hairs.

Carapace as long as tibia of second leg measured along its upperside, and as protarsus of fourth, slightly shorter than patella and tibia of third.

Legs: femur of first armed above with 3—2—3 spines; patella with 1 posterior spine; tibia with 3—3 spines below, 2 in front, 2 above, and 2 behind; protarsus with 2—2 below 2 in front, and 2 behind, all in the basal half: second leg armed like the first, but with one dorsal spine on tibia; third leg armed like the second, fourth leg like the second, but with only 1 distal spine on the posterior side of the femur.

Vulva consisting of an anterior transversely oval depression, followed behind by a somewhat quadrate plate consisting of two halves, which meet and form a sutural junction throughout the greater part of their length, and then diverge where the two sclerites dip into the epigastric fold.

♂.—The femora, coxæ, and tibiæ of the legs duller in colour beneath than in the female; the lower side of the abdomen covered with bright fiery yellow hairs, with no median black stripe.

Legs much longer (*cf.* measurements), carapace a little longer than the third tibia, a little shorter than the fourth tibia, about two thirds the length of the second; spine-armature of legs as in female.

Palpal organ (see figure, Pl. XIX. fig. 8 a); tibial spine slender and straightish.

Measurements in millimetres.—♀. Total length 32; length of carapace 14·2, width 11; length of first leg 54, of second 53, of third 38, of fourth 44; patella and tibia of first 21, of fourth 15·5.

♂.—Total length 27; length of carapace 14, width 11; length of first leg 75, of second 73, of third 50, of fourth 57; patella and tibia of first 38, of fourth 20.

Loc. Ugi and New Georgia (type), obtained by officers of H.M.S. 'Penguin'; specimens also collected by Mr. C. M. Woodford, probably in Shortland Island.

This species certainly differs from *P. ignicomus* of L. Koch ('Die Arachniden Australiens,' ii, p. 701) both in colouring and in the structure of the vulva and of the palpus. The type of *Palystes pinnotherus* of Walckenaer (Ins. Apt. i. p. 565), from Port Jackson, I have not seen; but the specimen which L. Koch identified by that name differs from *P. speciosus* at least in the form of the vulva (see L. Koch, 'Arachniden Australiens,' ii. p. 703, pl. lx. figs. 3-3 b). In Keyserling's collection there is an immature female, labelled *P.*

Genus HETEROPODA, Latr.

24. *Heteropoda venatoria*, Linn.

Loc. New Georgia (*H.M.S.* 'Penguin').

25. *Heteropoda* (? *Parhedrus*) *mecistopus*, sp. n.
(Pl. XIX. figs. 9, 9 a.)

Colour. Carapace mahogany-brown, with greyish-brown hairy clothing (mostly rubbed), black on the posterior slope, with a crescentic yellow band which extends laterally to the middle of the carapace; clypeus with faintly defined paler stripe; mandibles mahogany-brown, with blackish-grey hairy clothing, with indistinct paler bands; palpi and legs reddish brown, redder beneath, coxæ yellowish brown; sternum, maxillæ, and labium reddish brown; tibiæ and protarsi clothed above with silvery-grey hairs, intermixed with small dark spots; abdomen infusate, with an anterior median dorsal line extending throughout half its length; lower side behind the epigastric fold with a broad, but not strongly defined, yellowish-brown band about one third longer than wide.

Carapace rather low, flat above, considerably longer than broad (12·5 : 11), cephalic grooves strongly defined, a little more than half the length of patella and tibia of fourth leg, less than half those of first, and just about equal to patella, tibia, and tarsus of palp. *Eyes* of posterior line a little recurved, medians a little smaller than laterals and a little closer together than either is to its lateral; ocular quadrangle longer than wide, narrowed in front, the four eyes subequal; anterior line of eyes procurved; lower edge of medians, which are a little smaller, on a level with the centre of the laterals; clypeus high, the lateral eyes nearly three times their diameter from the edge.

Mandibles weak, feebly geniculate; fang-groove armed below with 5 posterior teeth, 4 large and 1 small one between them.

Palp (as in Pl. XIX. figs. 9, 9 a); terminal portion of palpus long and slender. Legs very long, 2, 1, 4, 3; tarsi and protarsi normally scopulate; patellæ with anterior and posterior spines.

Measurements in millimetres.—Total length 24; length of carapace 12·5, width 11; length of first leg 71, of second 75, of third 62, of fourth 69; patella and tibia of first 26, of fourth 24·8.

Loc. Probably Shortland Island; a single male procured by Mr. Woodford.

In the height of the clypeus and shape of the carapace this species resembles the genus *Parhedrus*; but in the curvature of the anterior line of eyes it more nearly approaches *Heteropoda*.

Genus PRYCHIA, L. Koch. •

26. *Prychia gracilis*, L. Koch.

Prychia gracilis, L. Koch, Die Arachniden Austral. ii. p. 654, pl. liii. fig. 1 (1875).

Two specimens of the genus *Prychia* obtained in New Georgia (*H.M.S. 'Penguin'*) are, I think, referable to the species named *gracilis* described by L. Koch from the Fiji Islands.

Family Attidæ.

Genus BAVIA, Simon.

27. *Bavia sex-punctata* (Dol.).

Salticus sex-punctatus (Doleschall), Nat. Tijdschr. Nederland. Indië, xiii. p. 24 (1857); id. Acta Soc. Sci. Indo-Néerland. 1859, pl. iv. fig. 8.

Marptusa sex-punctata, Thorell, Ann. Mus. Genova, xiii. p. 224, &c. (1878); id. op. cit. xvii. p. 444 (1881).

Acompse dulcinervis, L. Koch, Die Arachniden Austral. p. 1149, pl. c. fig. 1 (1879).

In this synonymy I follow Dr. Thorell, since a specimen of *Bavia* obtained by Mr. Woodford in the Solomon Islands, which appears to be identical with the species described by Koch as *Acompse dulcinervis*, also agrees seemingly with Thorell's description of *Marptusa sex-punctata*. Koch's specimens were from the Pelew Islands; those that Thorell examined from Amboina, Aru, Goram, New Guinea, &c.

Genus BATHIPPUS, Thorell.

28. *Bathippus* (?) *macropotopus*, sp. n.
(Pl. XIX. fig. 10.)

Colour. Carapace deep mahogany-brown, with metallic lustre at the sides, paler on the head and in the middle line of the thoracic portion, a few red hairs around the eyes; mandible mahogany-brown, with blue metallic lustre in front; legs and palpi a uniform ochre-yellow; abdomen duller yellow;

infusate on each side of the middle line above, and clothed above and at the sides with yellowish or reddish metallic hairs.

Carapace high; height from inferior edge up to lower border of posterior eye equal to length of ocular area; width about three quarters its length, length from clypeus to posterior border greater than length of tibia of second and third leg and than patella and tibia of fourth; ocular quadrangle a little wider in front than behind, its anterior width a little greater than its length. *Eyes* of middle line a little farther from anterior laterals than from posterior eyes, their lower edge in a straight line with that of the posterior eyes and with the upper border of the anterior laterals; the latter almost touching anterior medians; the lower rims a little higher than the centre of the medians, and the upper rims above the upper rims of the medians; clypeus less than length of radius of anterior medians.

Mandibles long, strong, and diverging; basal segment almost as long as carapace; posterior edge of fang-groove armed with about 12 longer and shorter teeth (differing in number and position on the right and left sides), and a large subquadrate tooth near the distal end; anterior border armed with a few small teeth near the base and a long strong spike about one fourth of the distance from the distal end; close to the joint of the fang there is also a blunt prominence and a small marginal spinule; *fang* long, strongly curved, with a triangular tooth on its lower edge just beyond the middle.

Maxillæ with convexly rounded external angle. *Palpi* long and slender, considerably longer than carapace; femur bowed; tibia one third longer than patella and nearly twice as long as tarsus, with the normal external distal spine; basal half of tarsus swollen, distal half cylindrical.

Legs 1, 3, 2, 4, long and slender, second reaching to middle of tibia of first; fourth just past end of tibia of third, first about twice as long as second; patella and tibia of third about equal to those of second, much greater than the fourth; coxa of first about twice as long as that of second; patellæ with anterior and posterior spine; protarsus and tarsus of fourth a little greater than patella and tibia of fourth.

Measurements in millimetres.—Total length 13; length of carapace 6, width 4.5; length of basal segment of mandible 5, fang 4; length of first leg 34, second leg 17, third leg 19, fourth leg 14, palp 8.

A single adult male obtained by Mr. C. M. Woodford, probably in Shortland Island.

This species appears to differ from all those from New

Guinea &c. ascribed by Thorell to the genus *Bathippus* in the exceptional length of the legs of the anterior pair.

EUSTIROGNATHUS, gen. nov.

Carapace almost as wide as long, head-region strongly elevated, its lightly convex upper surface meeting the posterior thoracic slope at an obtuse angle of about 135° ; sides of the thoracic portion about halfway above the lower edge distinctly depressed; ocular quadrangle longer than wide, longer than half the carapace, a little wider in front than behind. *Eyes* of second line about midway between those of the first and third; centres of anterior laterals on a level with upper rims of anterior medians; clypeus very narrow.

Mandibles (δ) of moderate length, diverging from the base, with strongly geniculate outer anterior edge, then converging and meeting, the inner or posterior extremity of the fang-groove being produced into a broad lobate process which meets that of the opposite side; the mandibles thus circumscribe a central piriform space, through which the rostrum and maxillæ may be seen; they are furnished in front and externally with a long smooth keel, running upwards from the base of fang, and below internally with a crest beset with stridulating-ridges; fang short.

Maxillæ much expanded distally, the antero-internal edge strongly convex, the external border of the distal portion strongly produced. *Labium* twice as long as wide.

Sternum subcircular.

Legs long and slender, 1, 3, 4, 2, third and fourth subequal, second only a trifle shorter; patella and tibia of third a little greater than those of fourth; protarsus and tarsus of fourth a little greater than tibia and patella of fourth; all segments of legs except tarsi spined.

Abdomen more than twice as long as broad.

According to Keyserling's tables of Australian Attidæ ('Die Arachniden,' ii. p. 1471 &c., 1883), this genus, neglecting the peculiarity of the mandibles, which may be sexual, falls alongside of *Iona*, Peckh. (*Erasmia*, Keys.), and *Prostheclina*; but, judging from the structure of the carapace, it has no near affinity with either. Tested by Mr. Peckham's tables (Tr. Wisconsin Acad. vi. p. 265, 1885), it also falls under the same heading as *Iona*.

29. *Eustirognathus oscitans*, sp. n.

(Pl. XIX. figs. 11-11 b.)

Colour. Carapace black, pale on the head, thoracic portion furnished on each side with a broad silvery band, the two

just meeting in the middle line behind; a silvery-white patch in the middle between the posterior eyes and one on each side below the eyes of the second line; red hairs in the space between the eyes of the anterior line. Abdomen pale in the middle, a broad black band stretching on each side to the spinners; sides pale, with silvery hairs; ventral surface pale, with a tuft of black hairs in front of the spinning-mamillæ. Second, third, and fourth legs pale yellow, with black spines, the tibiæ stained with deep brown, especially along their anterior and posterior sides; first leg deep ochre-yellow, with a heavy brown stripe running along the anterior and posterior margins. Mandibles, palpi, and mouth-parts deep ochre-yellow; tarsus of palp infusate.

Carapace with its cephalic area nearly flat above and almost horizontal, its height considerably less than the length of the ocular area. *Eyes* of second row minute, nearer those of the third than of the first; antero-laterals standing by about half their diameter above the upper edges of the medians, their diameter equal to about the radius of the latter; clypeus low, about half the radius of the medians.

Fang-groove of mandible armed with 5 strong teeth in front and 5 or 6 equally strong teeth behind.

Palpus short, reaching about halfway along the femur of first leg, its femur arched; patella and tibia subequal; tarsus piriform elongate, as long as tibia and about half the patella; tarsal bulb with a median blunt-pointed process running backwards alongside the tibial spur.

Legs long and slender; those of first pair thicker than the rest, with a fringe of hairs along the underside of the femur, tibia, and protarsus, and a slighter fringe on the upperside of the femur; tibia armed below with 5-7 pairs of longish spines; protarsus with 3-4 pairs. Patellæ of first and second unspined, of third and fourth with or without a posterior spine.

Measurements in millimetres.—Total length 8; length of carapace 3.5, width 2.5; length of first leg 14.5, of second 10, of third 10.5, of fourth 11; patella and tibia of first leg 5.5, of second 4.8, of third 3.5, of fourth 3; protarsus and tarsus of fourth leg 4.

Loc. New Georgia (*H.M.S. 'Penguin'*). A single male example.

EXPLANATION OF PLATE XIX.

Fig. 1. Conothele nigriceps, sp. n. Distal segments of palp from external aspect.

Fig. 2. Argiope leopardina, sp. n. Dorsal surface of cephalothorax and abdomen.

Fig. 2 a. Ditto. Lower surface of abdomen.

- Fig. 3. Araneus Woodfordi*, sp. n. Dorsal surface of cephalothorax and abdomen.
Fig. 3 a. Ditto. Vulva.
Fig. 4. Pasilobus mammatus, sp. n. Dorsal view.
Fig. 5. Actinacantha metallica, sp. n. Dorsal view.
Fig. 6. Gasteracantha signifer, sp. n. Dorsal view.
Fig. 7. Dolomedes laticeps, sp. n. Right palpal organ from below.
Fig. 8. Palystes speciosus, sp. n. Vulva.
Fig. 8 a. Ditto. Right palpal organ from below.
Figs. 9, 9 a. Heteropoda (Parhedrus) mecistopus, sp. n. Right palpal organ from below.
Fig. 10. Bathippus macroptopus, sp. n. Dorsal view.
Fig. 11. Eustirognathus oscitans, gen. et sp. n. Anterior view of head and mandibles.
Fig. 11 a. Ditto. Side view of carapace.
Fig. 11 b. Ditto. Labium and maxillæ.
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BIBLIOGRAPHICAL NOTICE.

Fossil Plants: for Students of Botany and Geology. By A. C. SEWARD, M.A., F.G.S., &c. Vol. I. With Frontispiece and 111 other Illustrations. Pages xviii and 452. 8vo. University Press, Cambridge. 1898.

THIS volume is one of the Biological series of the Cambridge Natural Science Manuals. The mutual bearings of Geology and Botany are well considered by the author in his preface, and clearly elucidated throughout his work. He intimates, with good reason, that both of these branches of science are rarely sufficiently well understood by one and the same naturalist; for a botanist will probably with ease get enough knowledge of geology, without working its deeper and more complicated problems, to be assured of its value in palæobotany; whilst, on the other hand, a geologist, taking up the subject intently, would require an intimate knowledge of the advanced and manifold researches of recent botany. In the third place, students having a general knowledge of natural science can find interest and instruction in such an earnest, clear, and comprehensive exposition of the principles and facts concerning petrified plants as this manual now before us.

The difficulty of clearing away the physical obscurities from fossil plant-remains, due to their imbedment, mineralization, and imperfections, doubtlessly delayed botanists from attempting to co-relate them with living forms to any great extent; and when they knew of the relative age and successional occurrence of these fossils, they could not feel sufficient interest to study their geological history in detail. Fossil-collectors, applying a limited knowledge of recent plants to the desired explanation of fossil leaves, fruits, and wood, made very slow advance; but they obtained some good results with careful use of the hand-lens. With the compound microscope, however, and the acquired art of making more or less transparent

slices of both fossil and recent specimens, sound knowledge accumulated from many sources. Under these circumstances both botanist and geologist were interested in the research; and one result arrived at was that the fossil plants, in many instances, could not be closely classified with those now known to be living, and were therefore assorted into other typical species and groups, with distinctive names. This was especially the case with several kinds of trees found fossil in the Coal-measures. Among British and foreign palæobotanists the late W. C. Williamson stands pre-eminent in his bold and successful exposition of the structural characters and biological affinities of these Carboniferous plant-remains. As a life-long geologist and experienced professor of botany Dr. Williamson combined all the requirements of a palæobotanist. There are others working on the same lines, and one of the most promising, and, indeed, successful, among them is the author of the book under notice.

In Part I. there are six chapters treating generally of the historical and geological aspects of the subject. Chapter I. sketches the ideas of the older observers, and the successful results of modern research. In Chapter II. the author considers the mutual bearings of botany and geology in a philosophic spirit, carefully and comprehensively, with the earnestness of personal knowledge. Chapter III. takes up the geological history, or broad features of the successive stages in the building of the earth's crust, and gives a condensed but clear account of the natural origin of conglomerates, sandstones, shales, and limestones, also of the superposition of strata with or without successional organic remains; there are also allusions to rock-foldings and dislocations, to metamorphism and igneous rocks. After a careful and suggestive "Table of Strata," the different formations are successively taken in hand, and their main characteristics briefly described (pp. 32-53). The continuous evolution of the earth's constitution is insisted on as proved by the details of its history. Chapter IV. (pp. 54-92) gives an excellent account of the preservation of plants as fossils under very different circumstances and in manifold conditions. First on surface-soils, both now-a-days and in far-past ages; for the frontispiece illustrates the stumps of a forest of Carboniferous age, now exposed near Glasgow, and the analogous fig. 5 (occupying page 59) shows the relics of a submerged forest of recent date on the coast of Cheshire. The local accumulation of plant-remains of all sorts and sizes in the great rivers of India, America, and Western Africa illustrates the origin of vast quantities of vegetable remains, often of different characters, in some strata. The peculiar local association of plants and animals, of various families and orders, both aquatic and terrestrial, in the Bowera Creek (p. 66) is, of course, noticed as an important example to be studied by palæobotanists. The conditions in which fossil plants occur, whether more or less altered and imperfect, and their stony or mineral constituents, their relative positions, and modes of imbedment, are next studied in considerable detail. Chapter V. treats of the difficulties and the sources of error

in the determination of fossil plants. External resemblances may easily deceive the inexperienced student, as shown by examples in figs. 20, 21, and 22. The venation characters are often doubtful as tests in family or generic affinity, and even for larger groups, as classes. Decorticated or otherwise imperfect casts of stems present difficulties, some of which receive interesting explanations at pages 102-105. Thus, the bark of one species of *Lepidodendron* is stated to have been described with twenty-eight specific names, under several genera. *Lyginodendron*, *Artisia*, *Steenbergia*, and *Tylodendron* have been referred to mere peculiarities of structure represented by casts. Contemporary insects, boring holes in plants before they were fossilized, have left their minute coprolites in abundance, easily mistaken for spores of cryptogams.

Some cautious, sound, well-timed, and therefore useful remarks on nomenclature and terminology, for the advantage of neophytes and others, close this chapter and Part I. of the book.

Part II. of this volume is occupied by descriptions of the plants constituting the lower divisions of the Vegetable Kingdom and the geological conditions under which they are met with. They are taken in their natural sequence, beginning with the lowest.

The Thallophyta (pp. 116-228) supply:—I. The Peridiniales, represented by *Peridinium pyrophorum*, Ehrenberg; II. The Coccospheres and Rhabdospheres, so common in the Chalk as well as in the ocean, are described as organisms of doubtful affinity, but probably algal (p. 121); III. The Schizophyta comprise (1) the Schizophyceæ (Cyanophyceæ) and (2) the Schizomycetes. The former are "fission-plants" or "blue-green algæ," and the latter are "fission-fungi." 1. The formation of many calcareous oolitic concretions is intimately connected with the presence of Chroococcaceæ and Nostocaceæ, members of the Schizophyceæ; and probably the *Girvanella*, a simple tubular organism to which oolites in several rocks are attributed, as also the *Zonotrichites*, may belong to this group. The building-up of both calcareous and siliceous sinters is regarded by some as due to the presence of some such low-class, filamentous, and gelatinous algæ. There are also minute boring algæ belonging to this group, which perforate and burrow in corals, molluscan shells, and fish-scales; and their analogues are found fossil. Besides helping to reduce these hard substances to debris, and, on the contrary, building up calcareous rocks, Cyanophyceæ have been probably efficient agents in preparing the mass of hot volcanic ashes in the island Krakatoa for the growth of highly organized plants, by occupying and modifying the surface under conditions which would be fatal to more complex types.

2. The Bacteria belong to Schizomycetes; and a most careful and cautious account of the researches that have led to the specification of Micrococcus and Bacillus, as well in the fossil remnants of plants that have suffered decomposition, as in coprolites of fish and reptiles (pp. 132-138), deserves attentive consideration. The possible error of mistaking spherical particles and rod-like bodies due to incipient crystals in calcareous and siliceous mineralization

is properly indicated, without throwing total discredit on the researches of earnest and conscientious observers.

IV. Algae succeed, and the impossibility of accepting very many of the so-called fucoids, or fossils referred to seaweeds, is reasonably insisted on. Other members, however, of the algal group are abundant both in recent and fossil states. The Diatomaceæ (Bacillariaceæ) are succinctly described as belonging to the "Brown Algae," and their wide distribution in existing waters, both fresh and salt, is analogous to their frequent occurrence, sometimes in enormously thick deposits, in the later geological formations. The oldest known fossil form has been found in the Lias: other forms are common in the Chalk; and others are vastly numerous in some Tertiary formations. For reasons given, the reported occurrence of diatoms in the Coal and in the Trias is not accepted.

The Chlorophyceæ, or "Green Algae," comprise the Siphonææ and Confervoidæ. Of the former, *Caulerpa* is a recent representative, and two fossils have been referred to it; but the Silurian *Caulerpites cactoides*, Göpp., is rejected, and the Jurassic *Caulerpa [ites] Curruthersi*, Murray, not accepted by the author. *Codium* and *Penicillus* come in the same category; the former has a doubtful fossil analogue (*Sphærocodium*), a limestone-maker of Triassic age. The author thinks that *Girvanella*, Bornemann's *Siphonema*, and *Sphærocodium* are closely allied and probably algal, but too imperfectly known to be referred to any particular family.

Penicillus has ten recent, mostly tropical, species; but in the fossil state there are many allied forms. These have mostly been described as foraminiferal, but have now been brought home to the Siphonææ by Prof. Munier-Chalmas. Of these reclaimed organisms the chief are *Acicularia*, *Polytrypa*, *Vermiporella* and others (Silurian), *Sycidium* (Devonian), *Diplopora* and *Gyroporella* (Triassic), *Dactylopora* (Eocene), and others, belonging to Munier-Chalmas's Siphonææ Verticillatæ, of which *Acetabularia* and *Cymopolia* are good recent types.

For the Confervoidæ several so-called Confervites have been recorded by geologists, but scarcely any of them are of value. At pages 178-183 "Torbanite" or "Boghead Coal" is discussed. It consists of minute light brown granules of hydrocarbon, with some earthy matter, and portions of the tissues of coal-plants. In the morsels of hydrocarbon in Torbanite and Kerosene-shale (known also as Tasmanite) MM. Renault and Bertrand see evidence of some Chlorophyceous? Algae, which they name *Pila* and *Reinschia*. The author seems to go with this opinion to some extent. It is noticeable, however, that the *Reinschia* represented by fig. 3 at page 180, although its hydrocarbon is somewhat modified, has much resemblance to a compressed macrospore, such as abound in Tasmanite. The important paper by Mr. E. T. Newton in the Geol. Mag. 1875, has escaped the author's notice.

Of the "Red Algae" group, the Nullipores (Melobesiæ and Corallineæ) comprise very important rock-builders in both recent

and past time. The "Brown Algæ" include the common *Fucus* or *Chondrus*, the gigantic *Lessonia*, and the floating *Sargassum*. A colossal fossil form (*Nematophycus*) is regarded (pages 192-202) as a doubtful member of this group; it is from Silurian and Devonian strata; and so is *Pachytheca*, possibly the sporangium of the same or an allied alga.

Of the very low-class Myxomycetes some possible representatives in the fossil state are referred to (p. 205). Fungi (pp. 207-222), chiefly parasitic on leaves and in the tissue of plants, from the Carboniferous period upwards, are not unfrequent. The Charophyta are well represented by *Nitella* and *Chara*, the latter in both recent and fossil state.

In Chapter VIII. the Liverworts occur fossil as *Marchantites*; and the Mosses as *Muscites*, one in the Coal-measures. In Chapters IX.-XI. the "Vascular Cryptogams" are described, with their fossil predecessors, so important in geological history. These Pteridophyta comprise:—(i.) Equisetales; (ii.) Sphenophyllales; (iii.) Lycopodiales; (iv.) Filicales. The external character and internal structure of the recent *Equisetum* are carefully described (pp. 244-254), and then the fossil forms—(1) *Equisetites*; (2) *Phyllothea*; (3) *Schizoneura*; (4) *Calamites*; and (5) *Archæocalamites*—are described in detail, with remarks on their relationships, geological position, and distribution. The *Calamites* (pp. 295-388) are more fully described than the others, with their bibliographic history, the description of the anatomy of their stems (*Arthroplitys*, *Arthro-dendron*, *Calamodendron*), their leaves (*Calamocladus* or *Astero-phyllites* and *Annularia*), their roots, and their cones (*Calamostachys*, *Palæostachya*, and *Macrostachya*), also the pith-casts of *Calamites*, *Calamitina*, *Stylocalumites*, and *Eucalamites* (pp. 367-379). A useful tabular summary of the different generic and subgeneric terms used by the author in this excellent account of *Calamites* is given at p. 381, defining the basis, in the special characters, for each group.

The palæozoic genus *Sphenophyllum* is defined as showing some points of contact with various living plants; but it is a nearly isolated type among the Pteridophytes of the Coal-measures. The anatomy of its stem, root, leaves, and cone is fairly well known, and the details are here carefully illustrated, together with remarks on the affinities, range, and habit of the genus.

The careful list of works referred to in the text fills 26 pages, and the excellent index (12 pages) completes this Vol. I. of a most valuable work, conscientiously and cautiously elaborated. With regard to the researches of others, whether botanists with more or less interest in geology, or geologists often with but little real botanical knowledge, the author is honestly critical, modest in the expression of his own opinions, and courteous in his disapproval, or, when necessary, in his rejection, of the views or statements of others.

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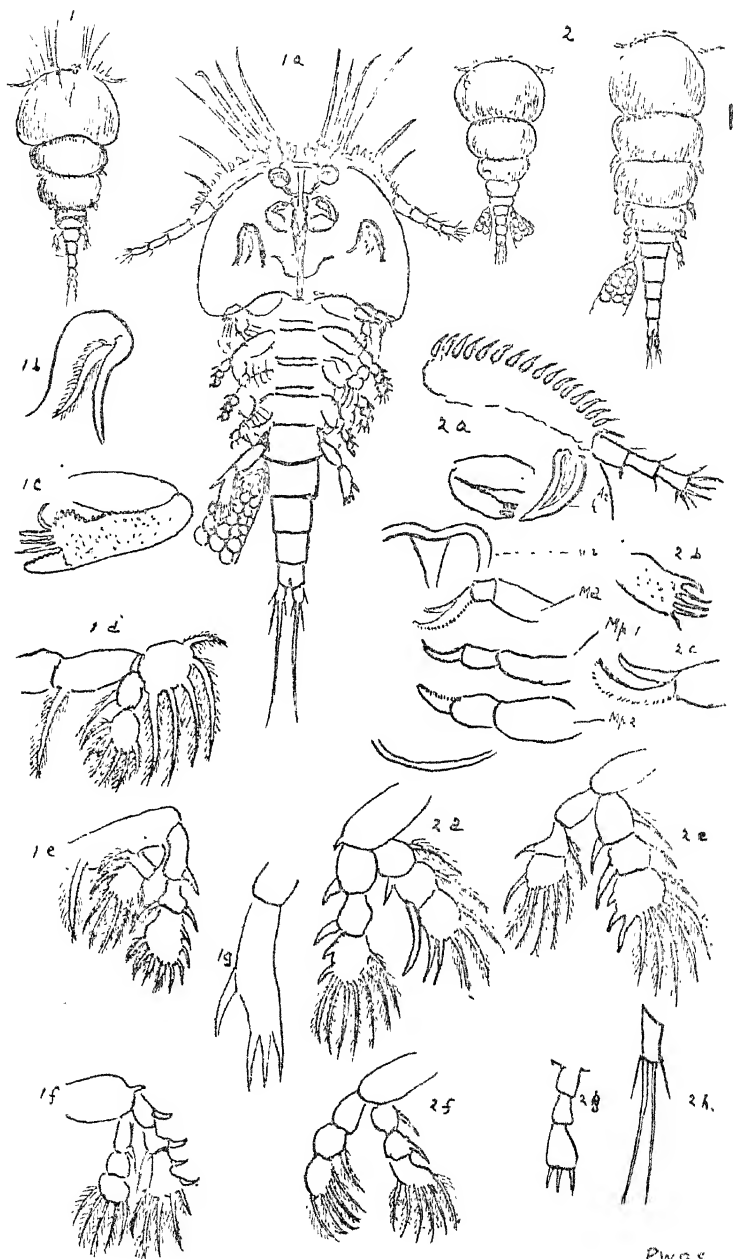
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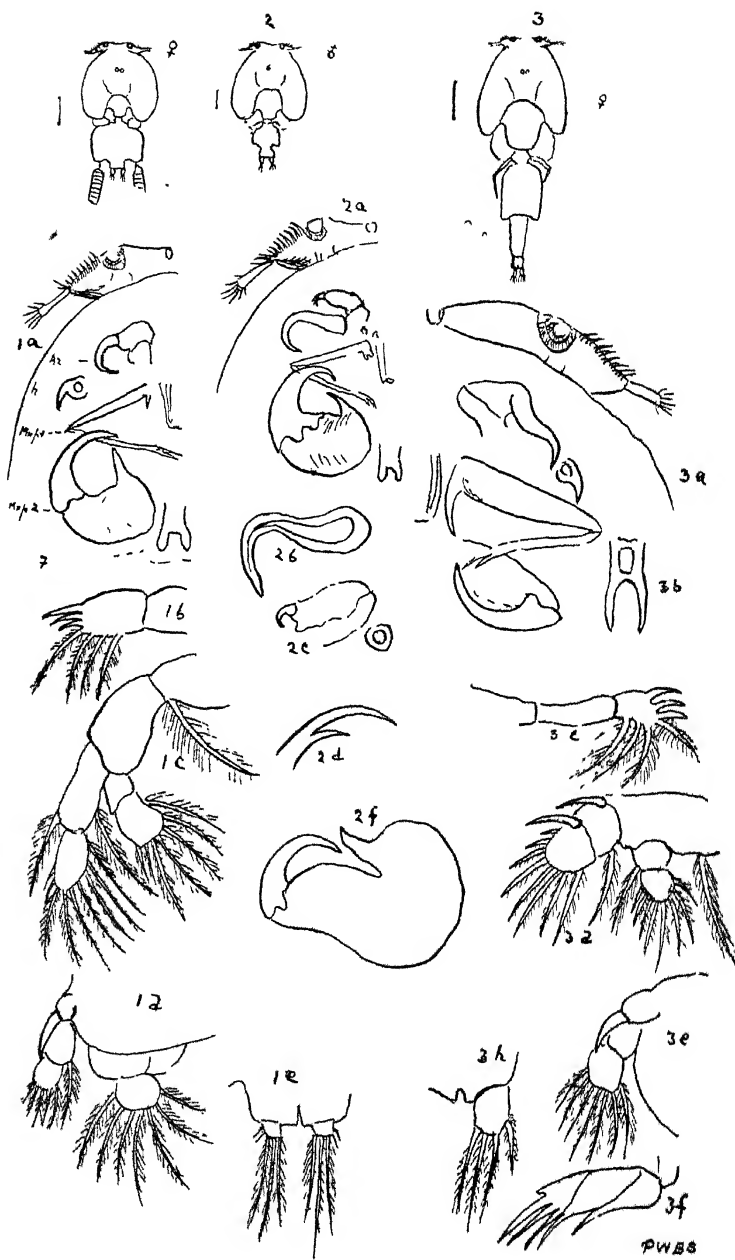
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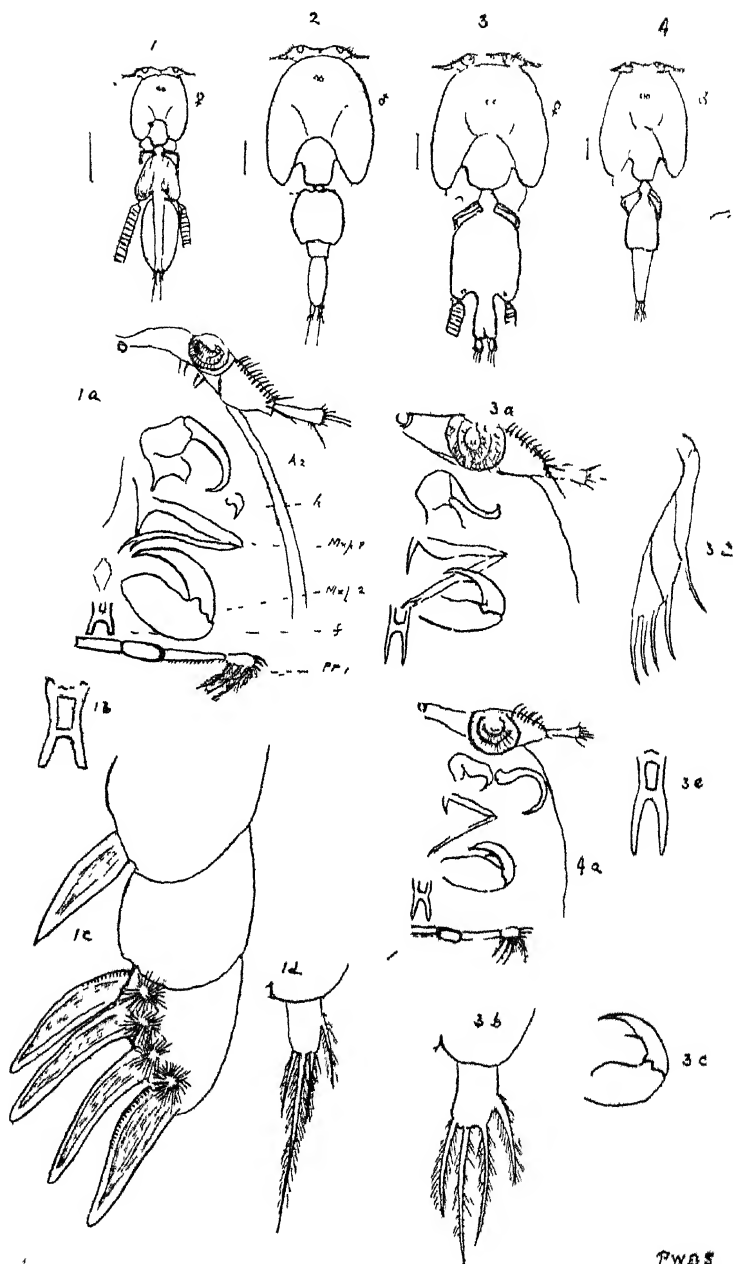
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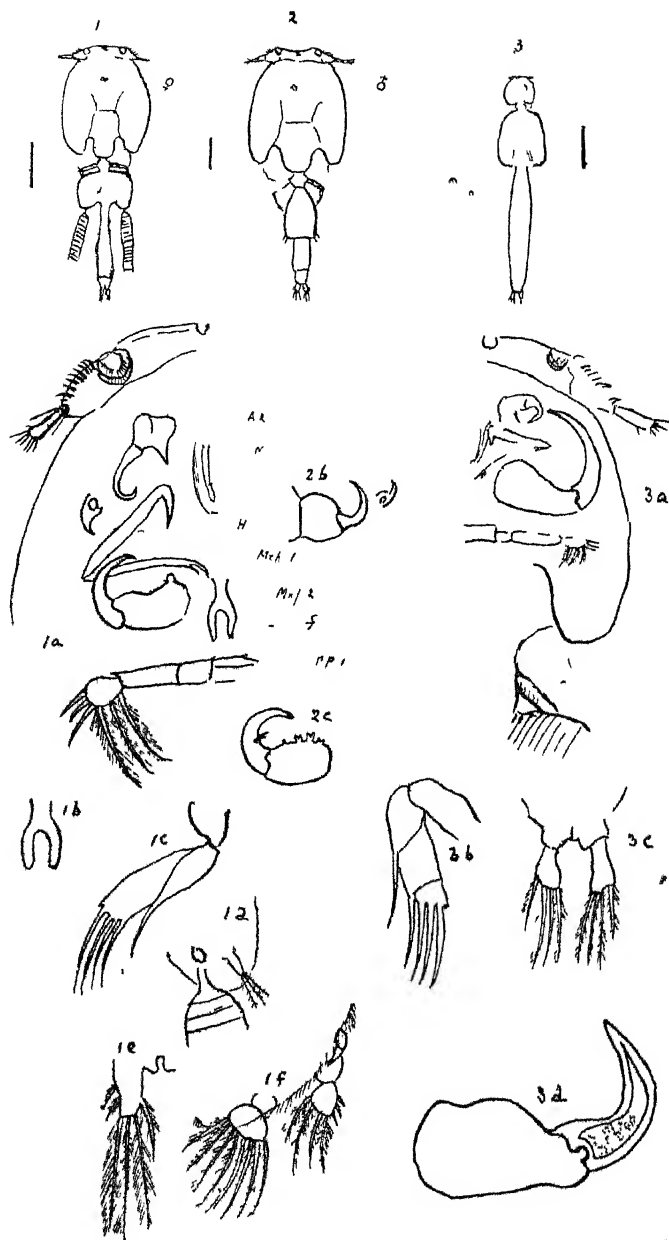
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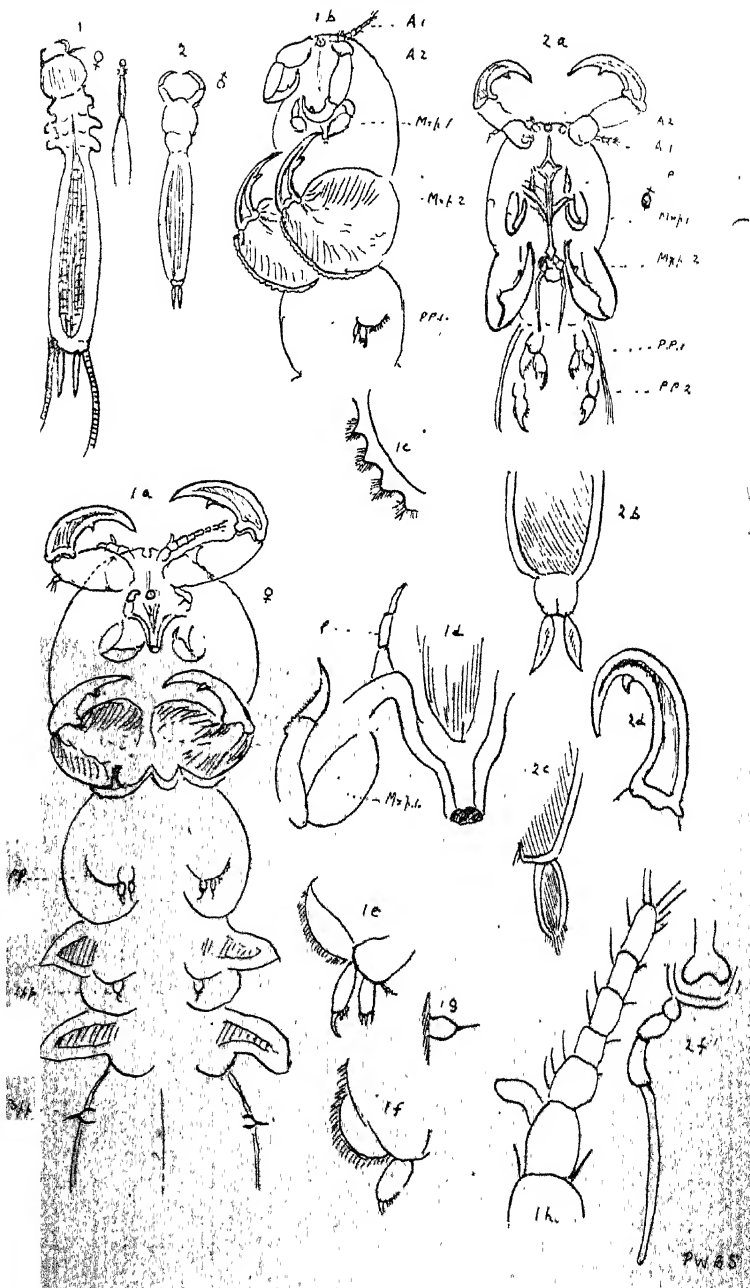
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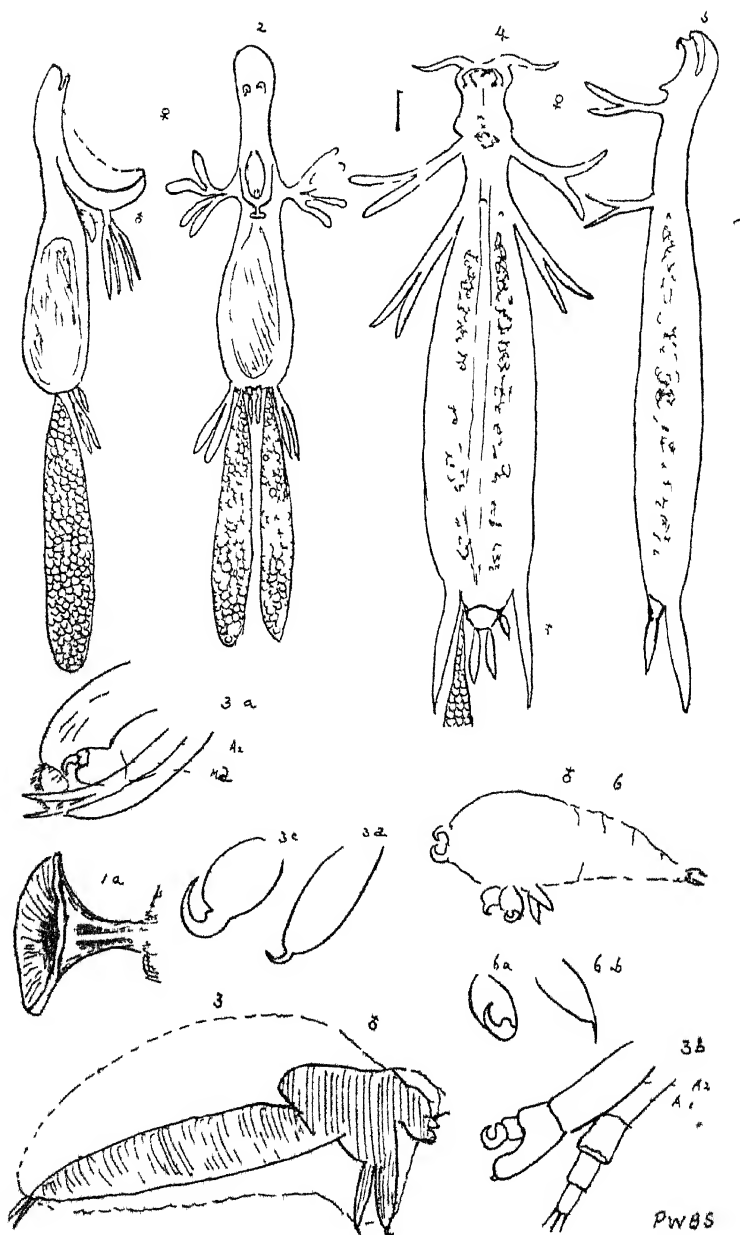


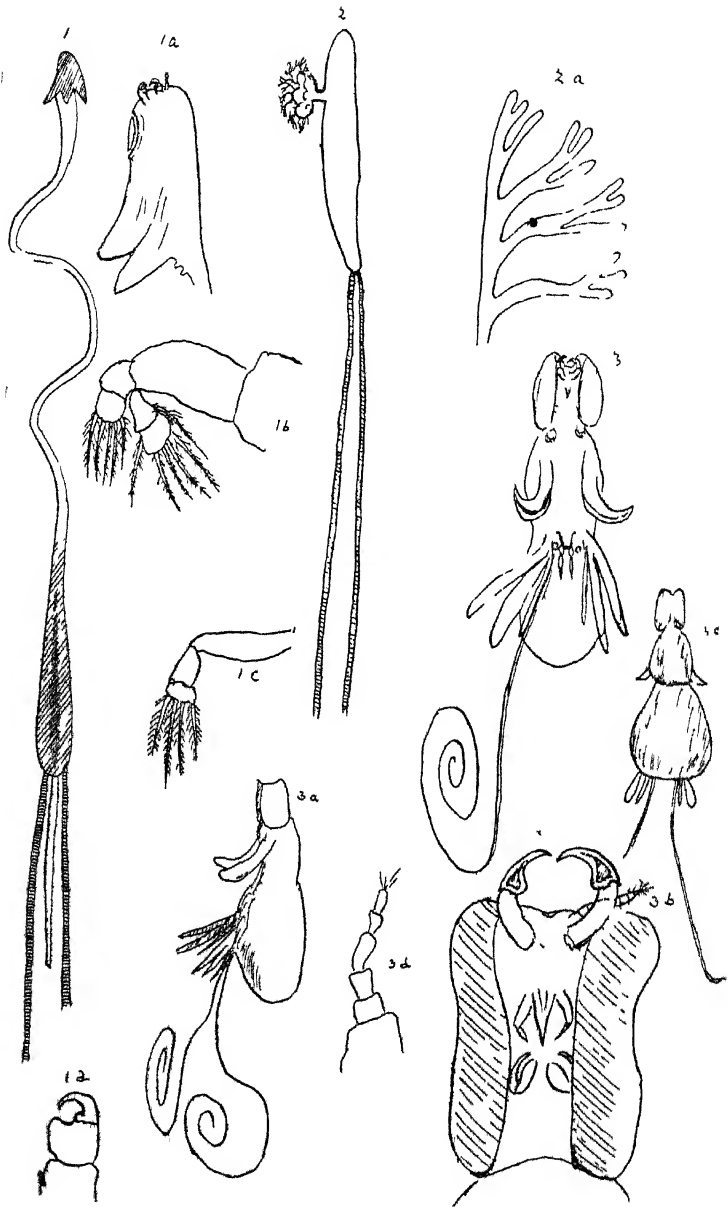














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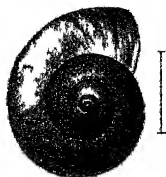
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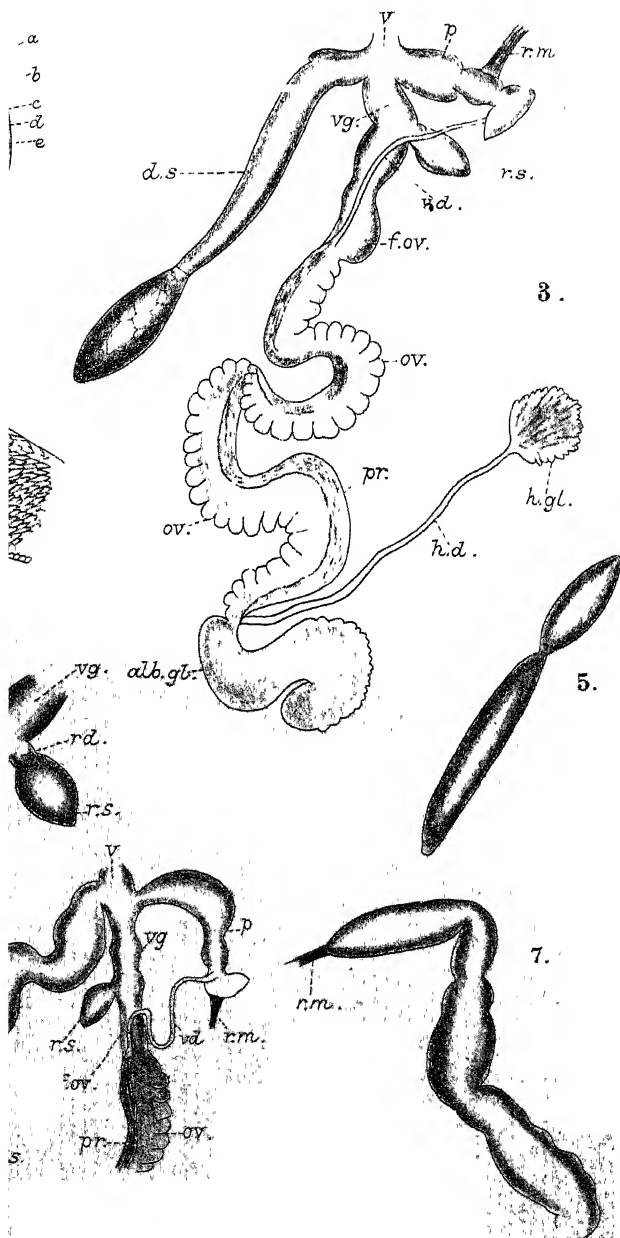


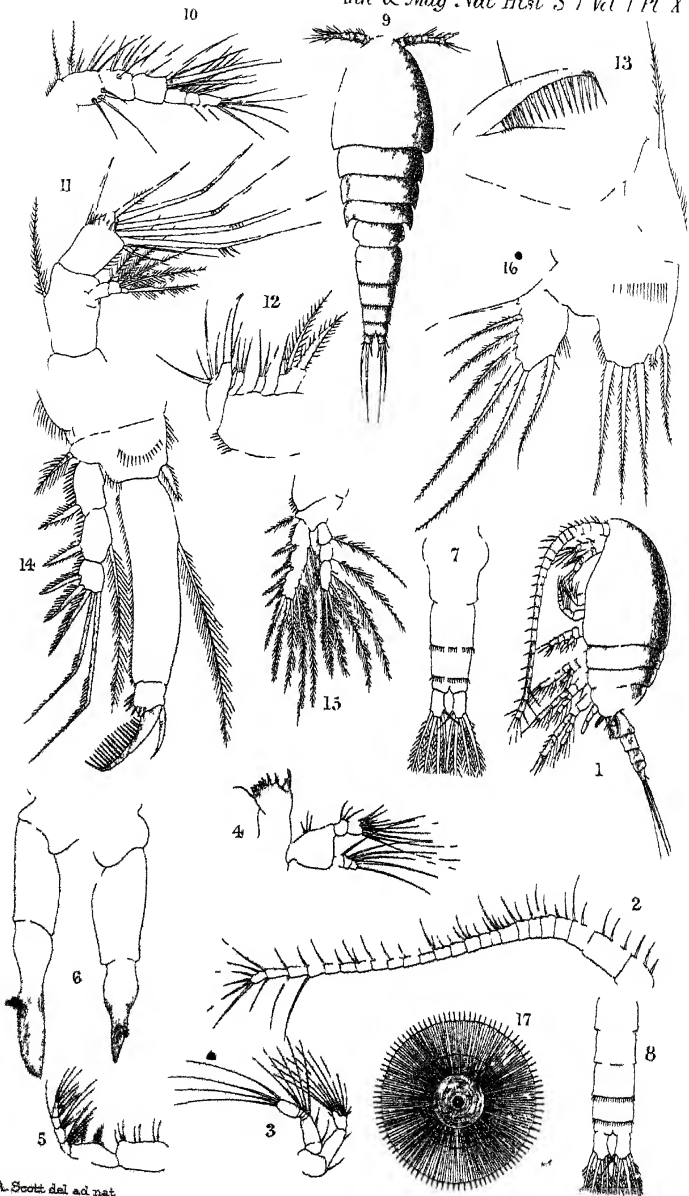
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A. Scott del. ad nat.

Minterm. Bros. lith.

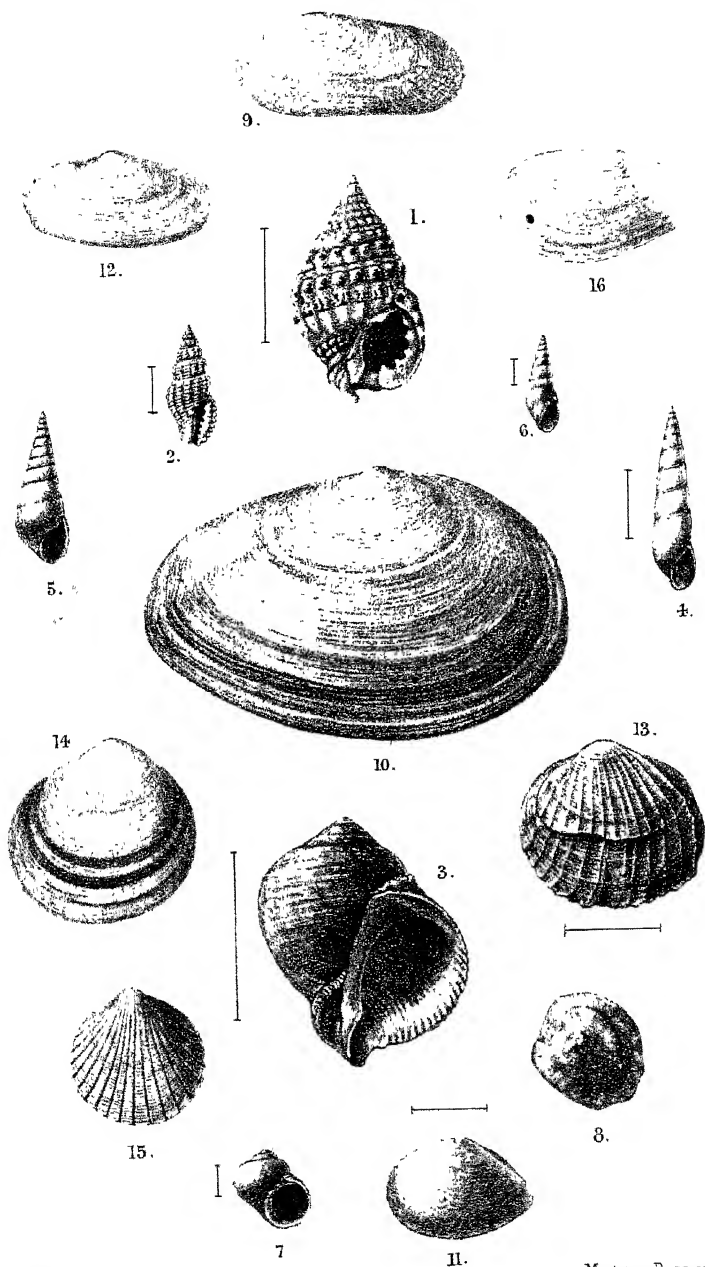
FIGS 18 STEPHOS FULTONI sp. n. FIGS 9-16 DACTYLOPUS PECTINATUS sp. n.
FIG 17 EURYNOTUS INSOLENS n. g. & sp.

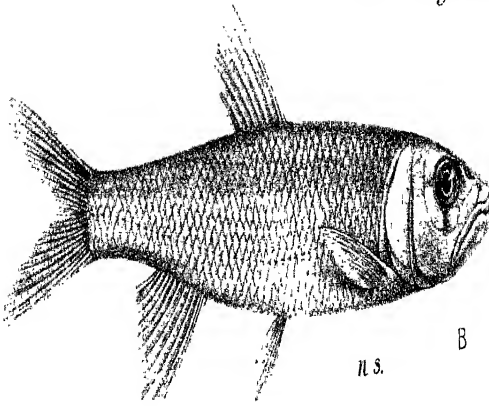


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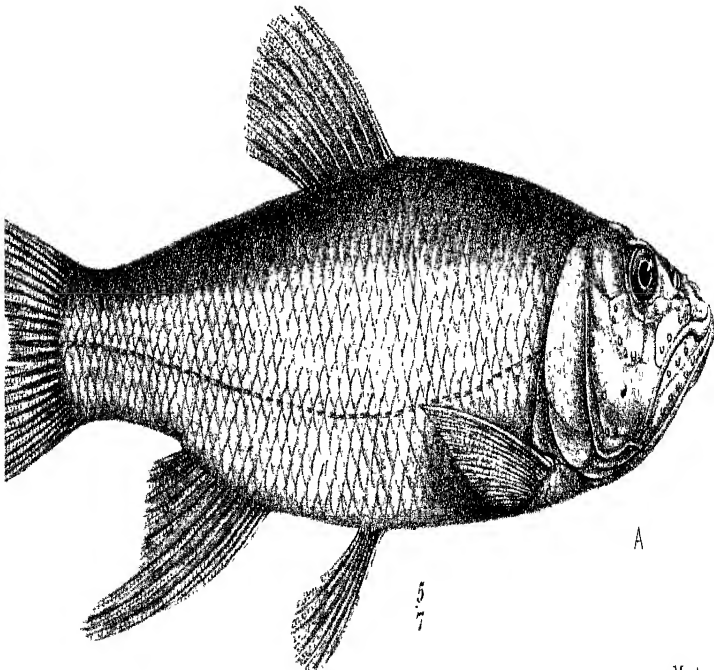
FIGS 1-4 STEPHOS FULTONI *sp. n.*
FIGS 5-13 EURYNOTUS INSOLENS *n. g. & sp.*





n. s.

B

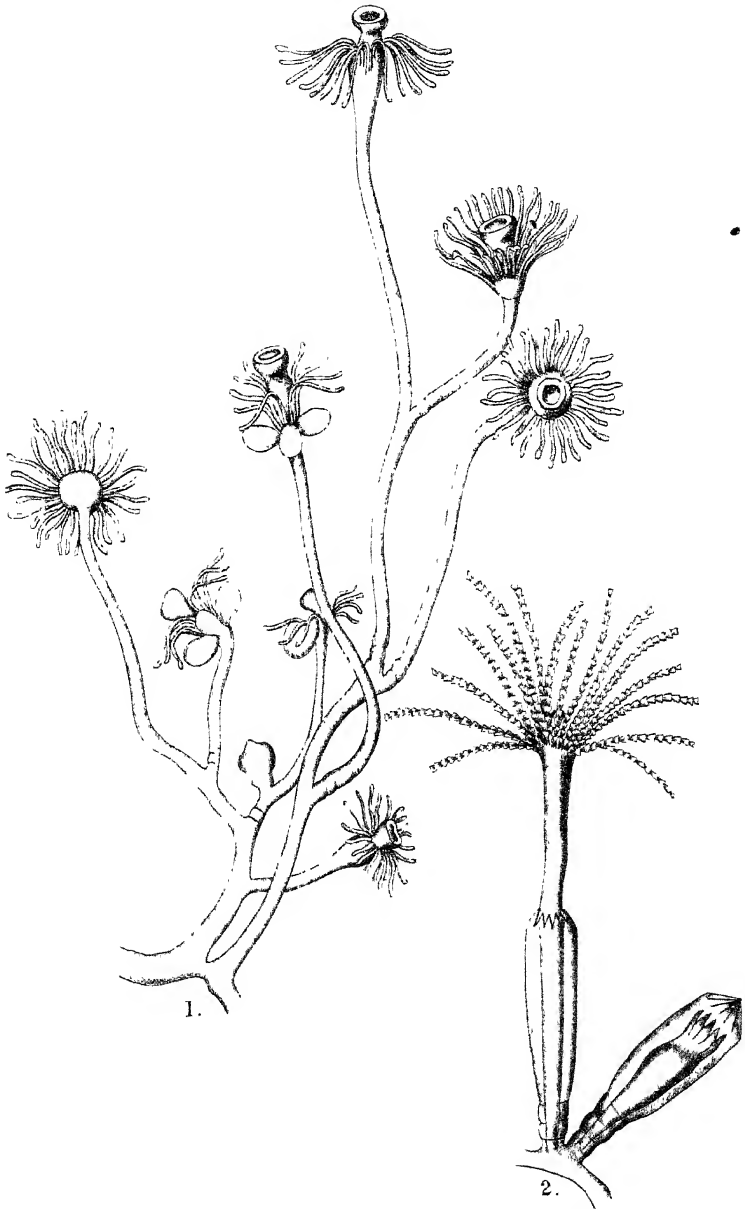


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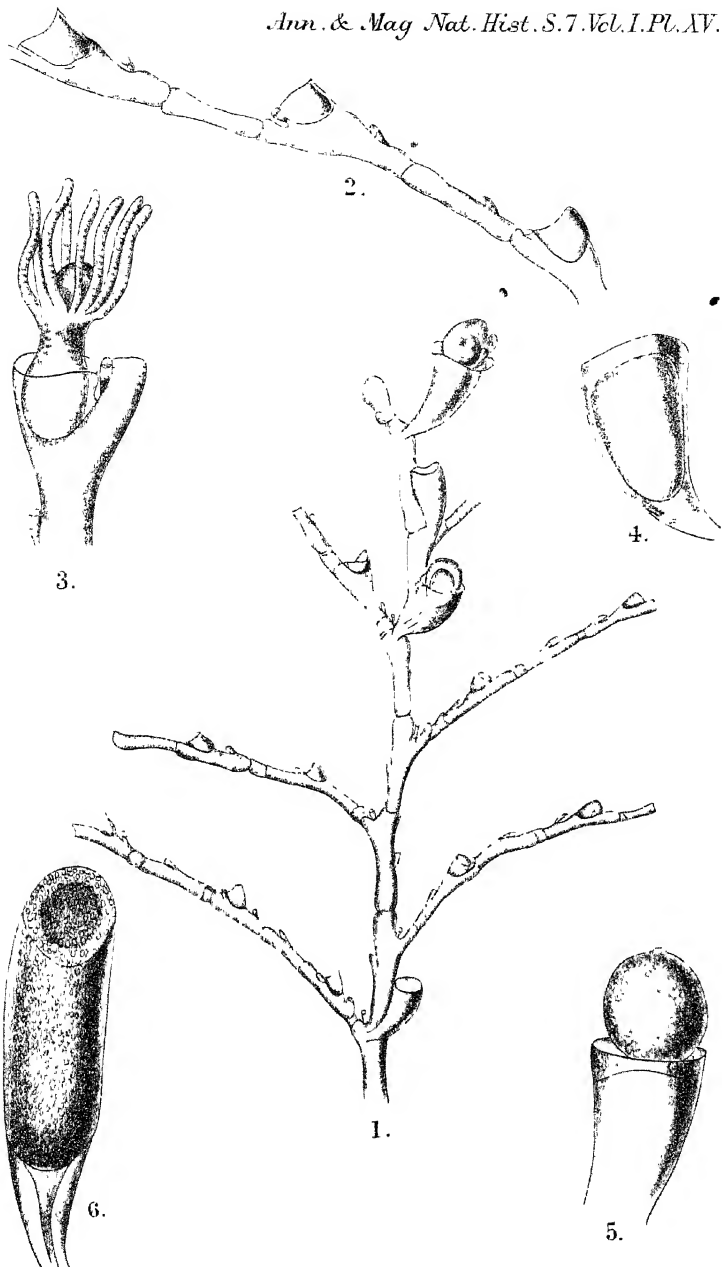
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Mary MacBride del

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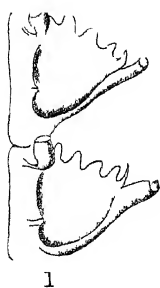
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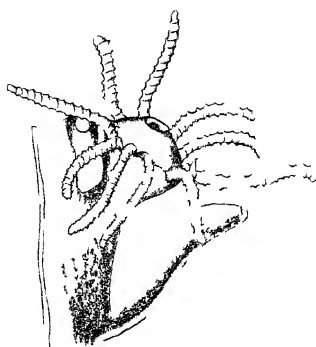
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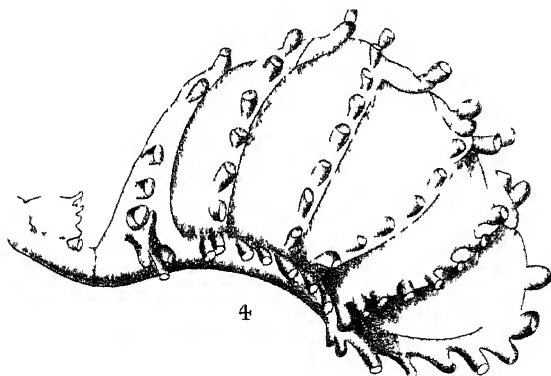
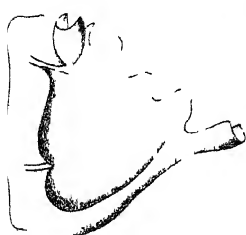
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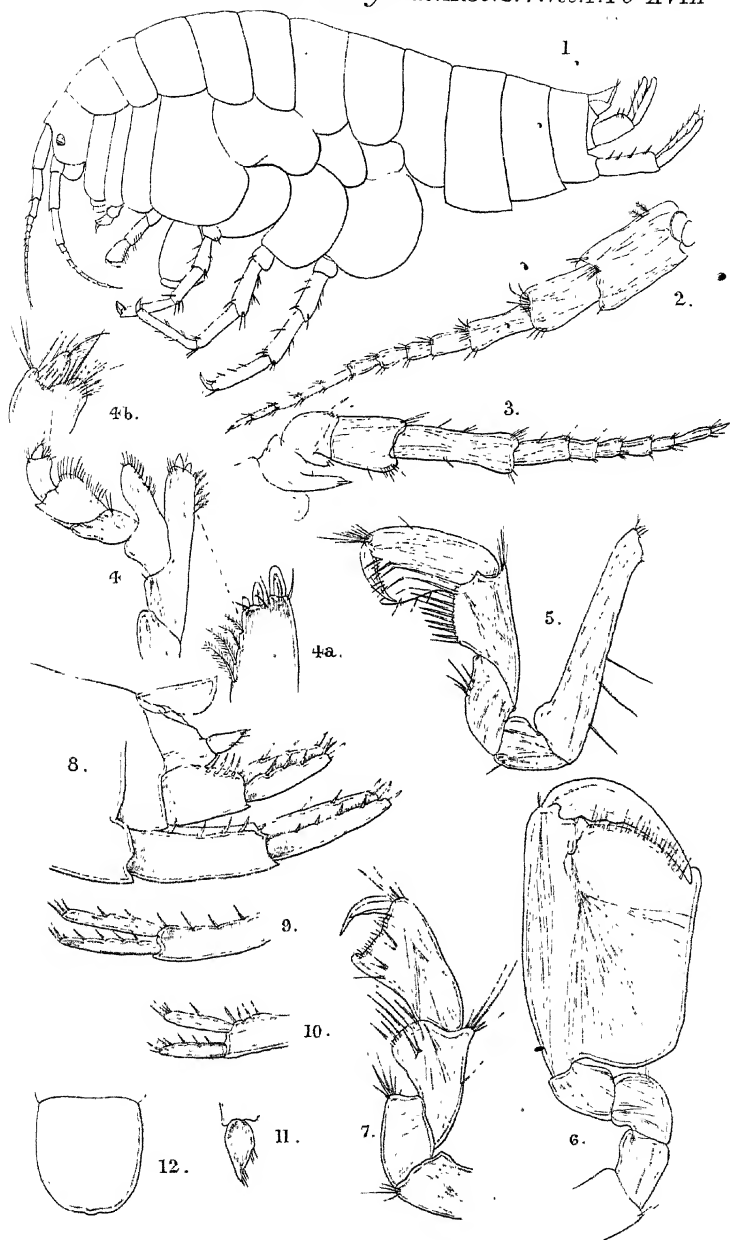
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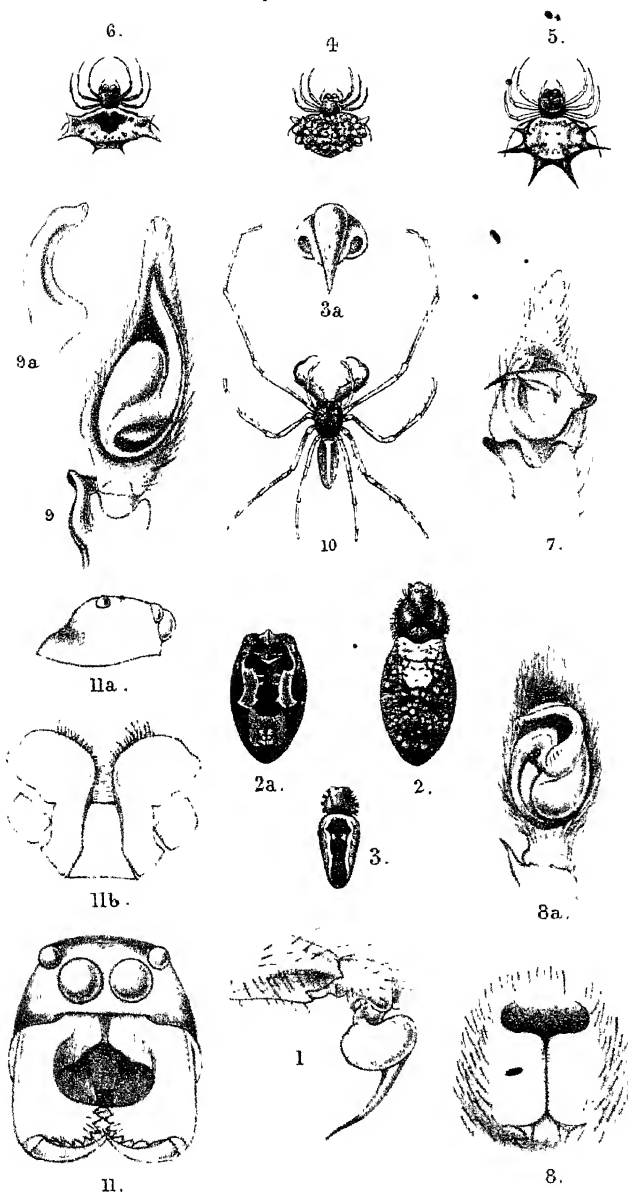


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• Marten Eros lth.

HYALELLA MIHIWAKA.



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